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A STUDY OF THE NORTHERN RAVEN

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Plates 1–3

THE first time that I ever came in contact with the Northern Raven (*Corvus corax principalis*) was in the spring of 1928 in the virgin white-pine forests along the shores of Lake Superior, at Whitefish Point, in the Northern Peninsula of Michigan, where several specimens were collected. The next time was in the Shenandoah National Park in Virginia in the spring of 1937. It is with the Ravens in the latter region that we have worked during the past few years. The first nest, which contained nearly-fledged young, was found on May 9, 1937, on Old Rag Mountain, while I was climbing the mountain with a group from the Mountain Club of Maryland, and it has been only through the efforts and help of some of the members of this club (namely, Mr. Osborn Heard, Dr. William Kemper, and Miss Alice Brown) that these studies have been possible, as I am too heavy to do any rock climbing.

Altogether, three nests were found on two mountains in the Shenandoah National Park, and both are accessible from Skyline Drive. The first and second nests were on Old Rag Mountain and the third nest was on Stony Man Mountain.

HISTORY OF THE NESTS

The nest on Old Rag Mountain, as stated above, was the first nest located. It was found on May 9, 1937, and contained four nearly fledged young, two of which we were able to reach by making a rather difficult climb.

On Saturday, March 25, 1938, a group again visited Old Rag, and three of the party climbed the mountain with bedding and food to spend a cold, miserable night in a wind-swept cave near the summit

where the temperature dropped considerably below freezing. We spent the morning scrambling over rocks, looking for the nest, hoping to find it either where it had been the previous year or near by on another ledge, but we had no success. About noon, the rest of the party joined us and one of the rock-climbing group went down to the last year's nest, using a rope, only to find the nest empty with no evidence of it having been used. In 1939 we were again unable to find the nest, although we made two trips and searched all of the cliffs and rock faces of which we know.

On Saturday, March 30, 1940, three of us again went to Old Rag and stayed overnight in Old Rag Shelter, one of the attractive open shelters in the Park, built from dead chestnut lumber by the C.C.C. boys. About dusk that evening, we had a most glorious view to the west with the distant mountains lost in a beautiful deep blue haze, over which hung billows of fleecy white clouds. As dusk deepened into darkness, with Old Rag silhouetted against the eastern sky, we crawled into our sleeping bags and were soon asleep. It was delightful to see the run rise over Old Rag in a clear and sparkling sky, and it was not long before we saw a Raven—then two and three, circling high over the mountain. By ten o'clock we were on top of the mountain, hunting over the cliffs and rock faces near the place where we found the nest in 1937, but after several hours of searching we had found no indication of either a nest or a roosting place, although the birds were flying above us most of the time. We were about to leave when we met some other climbers and asked if they had seen any Ravens. They replied that they had not, but they did know where a Crow was nesting on a ledge. They showed us the way to the nest, fully a quarter of a mile down the mountain from the Raven nest that we found in 1937, and much more accessible. The Crow's nest proved to be, in reality, a Raven's nest. It was on a ledge near the edge of a tumbled pile of huge boulders, and could be reached easily by the use of a rope, dropping over the edge of a large rock to the ledge on which the nest rested, about six feet below. There in the nest we saw, not eggs as we had expected, but a pile of nearly naked young, although we could not tell how many there were. From March 30 on, this nest was visited nearly every week end (in all kinds of weather—mostly bad) until May 4, when it was found empty.

On March 23, 1941, about a week earlier than our visit in 1940, the nest contained three young and two eggs, but on April 12 the nest was empty.

In 1942, because of gas rationing, we were able to visit the nest

only once. We found it empty and in a dilapidated condition. On our trip up the mountain we neither saw nor heard adults or young, and I believe the birds had gone to some other part of the Park, where food was more abundant and people were fewer.

The third nest, on Stony Man Mountain, was found in May, 1939, when the three young were about ready to leave. This nest was visited several times in 1940 and 1941, but in 1942 we were able to make but one trip because of gas rationing.

Altogether the three nests were visited 17 times. This may seem to be comparatively few, but when it is realized that each visit meant a week-end trip and a drive of nearly 200 miles, it may not seem to be such a slight accomplishment, particularly when we had no "Uncle" to pay for the trips.

DISTRIBUTION

The Northern Raven, the more common and more widely distributed of the two subspecies in North America, at one time was to be found over all North America east of the Rocky Mountains, but is now found only in the more remote and isolated parts of the continent from Alaska to Greenland; south to the Great Lakes; along the Atlantic coast to Maine; in the Adirondack wilderness of northern New York; and in the higher Alleghenies as far south as Georgia. This is but a fraction of its former range. The last-named locality includes the Shenandoah National Park where, under protection, they seem to be increasing. I have seen as many as ten along the one-hundred-mile drive of the Park. Unlike the common Crow, which seems to thrive near civilization, the Raven has retired and is today as much a bird of the wilderness as it used to be.

In appearance, the Raven is much like the common Crow for which it is sometimes mistaken. It is glossy blue-black with some metallic luster, but is nearly twice the size of the Crow. The Crow is about 19 inches long and the Raven about 26 inches. Unlike the Crow, the Raven has long, pointed, lanceolate feathers on the throat, with each feather lying separate, one on the other, and not softly blended as in the Crow. The Raven also has a heavier bill than the Crow. To me, the Ravens are stately and rather sedate birds whose movements when on the ground are deliberate and dignified, but when in the air they appear to still better advantage, although to the unaccustomed eye they would not be distinguished from the Crow, unless they were accompanied by Crows, when their larger size would be apparent.

I believe that there is very little migratory movement among Ravens

—that they are permanent residents wherever they are found; we have seen them at all seasons of the year in the Park. Very few data are available and the banding files of the Fish and Wildlife Service have only four returns from a comparatively few banded birds. These returns are for birds banded in Nova Scotia and Labrador, and are all local. We have banded only eleven nestlings—five in 1940 from the Old Rag nest, and three in 1940 and 1941 from the Stony Man nest—and have had no returns from them.

It is believed that the Raven, like most of the larger birds, mates for life. From the actions of the two pairs at their respective nests, I would agree with this belief; undoubtedly, the same pair of birds used the same nest in successive years.

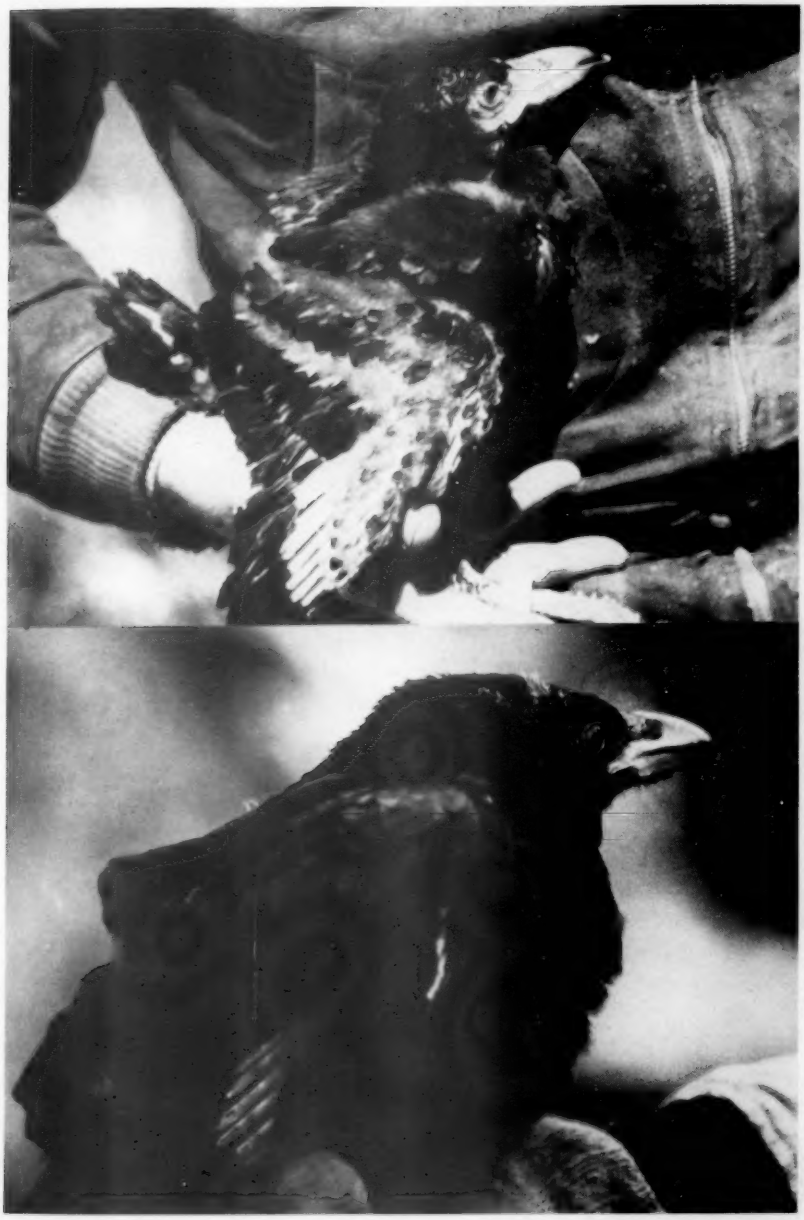
I have no data on the courtship.

Food

The food of the Raven consists of anything edible, alive or dead, which it can catch, kill, disable, or pick up, and no doubt it is almost as varied as that of the Crow, but the greater part is probably carrion, with small mammals next. W. B. Barrows, in his 'Michigan Bird Life' (1912), says of a Raven that nested in a deserted building: "The floor of the building was strewn with pellets consisting principally of fish bones, skeletons of small mice and some insects." We were unfortunate in not finding any food remains at the nests, although on one visit there was an exceedingly strong odor of carrion. But in the files of the Food Habits Research Section of the Fish and Wildlife Service, we find mention of the following items: carrion, mice, squirrels, rabbits, and other small mammals, young birds, eggs of the larger birds, as ducks, herons, etc., fish, crabs, insects, corn, fruits, and seeds of juniper and similar trees. An incident was related to me of a Marsh Hawk that was put in a cage with a Raven. In the morning all that was found of the hawk was the leg bones and the larger feathers. Another interesting incident regarding the Raven's food was told to me by one of the Park naturalists. He said that often in the early morning they would find the trash cans in the picnic areas overturned and the contents strewn about. They had always suspected the raccoons or opossums, but one morning they discovered that the culprits were Ravens.

The most common call or note of the Raven is, as Chapman describes it, a hoarse, guttural, rolling *cr-r-r-cruck*. At times, particularly when we were at the nest, we heard other calls and notes, which are extremely difficult to describe. There was a sharp, staccato alarm-call when we were discovered at the nest, and a low, guttural note

NORTHERN RAVEN.—YOUNG BIRDS LESS THAN ONE WEEK OLD.



NORTHERN RAVEN.—*(Upper)* YOUNG BIRD ABOUT THREE WEEKS OLD; *(Lower)* ABOUT FOUR WEEKS OLD.

which we interpreted as a soothing call to the young. On one occasion at the nest on Stony Man, after we had flushed the female from her eggs, she circled, swooped close to us, scolded, and then flew to a near-by dead tree and uttered a series of calls that sounded like a person snoring.

NESTS AND EGGS

The three nests that we found in the Shenandoah National Park were in crevices or on ledges on cliffs or rock faces. The first nest was rather inaccessible, and could be reached only by a difficult climb with the help of a long rope. The second nest was on a ledge that could be reached easily by dropping about six feet over a large boulder. The third nest was on a ledge about fifteen feet down the face of a 200-foot cliff.

Farther north where rocky ledges are not available, Ravens often build in tall trees, preferably pines. In most cases the nests are used year after year. We were told that the first nest we found had been used for several years; the second nest was used only three years; and the third nest had been used at least four years, and probably more.

The nests were composed of sticks, from a few inches to three feet in length, and from one-eighth to one-half of an inch in diameter, with an inner cup lined with shreds of grapevine bark and what looked like sheep wool and opossum fur.

The size of the nest depends on the size of the ledge on which it is built. The first nest was in a rather small crevice and was comparatively small; the second nest was on a ledge and measured 32 × 38 inches, with the inner cup about 12 inches in diameter and 7 inches deep; the nest on Stony Man was on a small ledge and was about 18 × 24 inches, with the inner cup about 10.5 × 12 inches.

The egg of the Raven is roughly about 1.5 × 2 inches, or about the size of a small chicken egg. The eggs are greenish, splotched and spotted with various shades of olive brown. From three to seven eggs are laid, about the first week in March. We found two eggs in the Stony Man nest on March 1, 1942. This undoubtedly was an incomplete set, for in the three previous years, three young had left the nest each year. On March 9, 1940, Miss Bonnell (who had shown us the second nest on Old Rag) found six eggs.

The incubation period is about three weeks, and it is believed that both parent birds help with the incubation as well as with the care and feeding of the young. In the nest that contained six eggs on March 9, 1940, the young were about a week old on March 30, and in 1941, on March 23, a week earlier than the previous date, the nest contained three young and two eggs.

DEVELOPMENT OF YOUNG

The young, when hatched or when only a day or two old, are not things of joy and beauty. In fact, they reminded us of grotesque gargoyles. Their eyes were closed and here and there on their otherwise downless bodies were small patches of grayish down. The abdomens were greatly distended and as smooth as a billiard ball but far more colorful, with bluish vessels showing through the dark pink skin, and the corners of their mouths protruded and hung down like jowls. The nestlings could utter only the most feeble sound, but could always react for prospective food, which they did whenever we touched them. The temperature of the nearly naked young in their nest was always high, even on the coldest days. We took a thermometer with us to determine this temperature, but unfortunately it was broken, even though we carried it in a metal tube.

Like most young birds, they grew rapidly, and in a week's time had changed considerably. A few feathers were beginning to appear, pushing off the down, and their feet and bills had developed disproportionately.

On our visit to the Old Rag nest on April 21, 1940, when the young were about three weeks old, we encountered the worst weather conditions that we had experienced. Up near the nest the ground was covered with snow, the trees and the exposed rocks were coated with ice, and there was a cold wind that must have been blowing thirty or forty miles an hour, and that penetrated all our clothes and chilled us to the bone. Although we were cold, the young Ravens were warm and comfortable in their nest, which was well protected from both wind and snow. They were well-feathered now, with little or no down showing, and they had the characteristic appearance of Ravens. It was so cold and blustery on that day that only one young bird was taken out, and it was returned as soon as possible. It was interesting to watch the bird when we put it on the rock above the nest. It made no attempt to keep its head into the wind and often got its feathers rumpled. Once it was almost blown off the rock. It was not yet able to stand on its feet, but managed to move along on its legs.

When the young were about five weeks old they usually had left their nest though not the care of their parents. On May 5, 1940, at the Stony Man nest, when the young were about five weeks old, they were still in the nest when we arrived early in the morning, but when the person who was lowered over the cliff got close to the nest, one bird flew with faltering wings, then another, and finally the third. It was interesting to watch them on their first awkward flight, for

frequently they would lose their balance in a gust of wind and drop several feet before righting themselves.

As I stated before, we were unable to find any food remains in the nest, nor did we see the parents feed the young, but it is believed they feed by regurgitation. On two occasions we made an improvised blind at the base of a dead tree about a hundred yards from the second nest on Old Rag. One person stayed in the blind while the others returned to the trail, making as much noise as possible, hoping to distract the attention of the adults and hoping that they would return to their nest, but the ruse did not work. The birds would fly over, craning their necks and looking down at the blind, fly toward the nest (no doubt seeing that the young were there) and then fly off over the rocks and be lost to view. After about an hour in a cramped position, sometimes numbed by the cold, we gave up the thought of them ever returning.

The attitude and actions of the two pairs of birds at their nest were extremely different. Usually when we arrived at the nest on Old Rag the adults were nowhere to be seen, but with the calling of the young when we were handling them, the adults would appear. One of the adults, which we supposed was the female, would become excited, although she never came very close to us. She would perch on a limb of a near-by dead tree and hammer away at it with her heavy bill, breaking off good-sized pieces, and then after fumbling them around in her bill, would shake them vigorously before dropping them to the ground. The other bird of this pair usually perched in a tree on the other side of the ravine.

The adults at the Stony Man nest acted quite differently. One of the pair was always at the nest and the other one was near-by. When we were still some distance away they would become excited and, when one of us went over the cliff down to the nest, both birds would swoop down and come within a few feet of him.

The worst enemy of the Raven is man. But under the protection of the Park these birds are increasing in numbers. As to their economic status, they are scavengers and no doubt do far more good than harm.

It is always with a feeling of deep regret that we realize that our visits to the Raven's nest are over for the year, but we are always planning and looking forward to our trips the next year, hoping only that the Ravens will again use the same nests.

Takoma Park
Maryland

INCUBATION AND NESTLING PERIODS OF CENTRAL AMERICAN BIRDS

BY ALEXANDER F. SKUTCH

RECORDS of the incubation and nestling periods of birds are of both practical and theoretical importance. The incubation periods of numerous kinds of North Temperate birds have been published both in special lists, as those of Burns (1915) and Bergtold (1917), and in life-histories of particular species. The nestling periods have, on the whole, received less attention. For tropical birds, very few periods have been published—indeed, tropical ornithology, in every respect save pure systematics, is a branch of the science still in its infancy. An outstanding exception is the list of incubation and fledgling periods of African birds published by Moreau and Moreau (1940), which breaks ground in this field. No comparable information for Neotropical birds has, to my knowledge, ever been presented. As to Central American birds in particular, I doubt whether a score of incubation periods have been given in print, and those chiefly in my life-history studies that have from time to time appeared in 'The Auk.'

The incubation and nestling periods given below have been gathered over a space of fifteen years, in Guatemala, Honduras, Costa Rica, and Panamá. They represent the successful harvest of a very much greater number of attempts to determine these intervals, which failed because of the premature loss of nests. In heavy lowland forest, especially, the gathering of this information is a most discouraging business, for the great majority of birds' nests are prematurely destroyed. Of 35 nests that I attempted to follow through in lowland forest in Panamá, in 1935, only five, or 14.3 per cent, came to a successful conclusion—that is, produced at least one fledgling. In other forested regions of the lowlands, my luck has been scarcely better. But in the Guatemalan highlands, between 8,000 and 9,000 feet above sea level, 37 of 67 nests, or 55.2 per cent, were successful.

There has been a lamentable lack of uniformity in the mode of determination of incubation periods, so that if one wishes to make a comparison of different species—to investigate, for example, whether there is an acceleration in the time of hatching with increasing latitude—he is at a loss to know what data it is safe to accept. Some writers have measured the incubation periods from the laying of the last egg to the hatching of the first nestling, which may give a value too short, as the bird may begin to incubate before the set of eggs is complete. The best recent practice has been to calculate the period from the laying of the last egg to its hatching (Nice, 1937). By this

method, the uncertainty as to whether the earlier eggs received any incubation before the set was complete will not introduce an unknown quantity into the results. Sometimes the bird will incubate only sporadically during the first day or so after the set is complete, only gradually 'warming up' to the task. This introduces another element of uncertainty into our periods. But since it rarely happens that the observer has both the time and the patience to watch the nest continuously on the day the last egg is laid, it is a source of error that in practice can scarcely be avoided. The best we can do is to define the incubation period, somewhat arbitrarily, as the interval between the laying of the last egg and the hatching of the last nestling.

It might be objected that after the first egg hatches, the parent leaves the nest to find food for the nestling, with the result that the remaining eggs are no longer warmed as constantly as before, and the rate of development of their embryos is retarded. Actually, studies of a number of species, in which one or both sexes incubate, show that there is, as a rule, only a slight decrease in the total time the nest is covered during the first day or two after the nestlings hatch. I have known female birds whose mates began promptly to bring abundant food—as a Streaked Saltator and a Gray-headed Nightingale-Thrush—to increase their time on the nest after the hatching of the first egg. If, as usually happens, all the eggs in the set hatch within a day or two, there is no reason to suppose that the hatching of the last has been retarded by lack of warming.

I use, to fix the end of the incubation period, the hatching of the last nestling, rather than of the last of the eggs to be laid, because, unless we mark the eggs, we can not be sure that the last laid was the last to hatch. In my own experience, when I have marked eggs, they have hatched in the order of laying; but the Moreaus noted exceptions to this rule. While with fairly large eggs in an open nest within convenient reach, marking the shells presents no difficulties, for a great many species, especially between the Tropics, it is a hazardous undertaking. Woodpecker eggs can not be marked unless we saw a hole in the side of the trunk and remove them from the cavity; no matter how carefully this is afterwards closed, we have decreased the birds' chances of a successful nesting. Other nests are in thickets and vine-tangles above our heads; to reach them we must set up a ladder, disturbing the surrounding vegetation and making the nest more easily discoverable by predators. Many eggs are in closed nests with doorways so narrow that it is difficult or impossible to remove them without injuring the structure; and still others, like those of

hummingbirds, are so minute and delicate that we hesitate to apply the point of a pencil to their shells.

For these reasons, I have come to depend more and more upon mirrors for looking into closed nests of all sorts, and into open nests above the level of my eyes. When necessary, the dark interior of the nest is illuminated by inserting a small electric bulb. The one uncertainty which the use of mirrors introduces into the determination of the incubation period is whether the last egg to be laid is the last to hatch, since the eggs are not marked. This uncertainty assumes serious proportions when one or more of the eggs in the set fail to hatch, for then one can not be sure that the last to be laid has hatched. By way of compensation, fewer nests are lost. If eggs do not always hatch in the order of laying, then there is a variability in the length of the incubation period which will appear if determinations are made at a number of nests.

As a general rule, I have made only daily visits to my nests. As the Moreaus have pointed out, this allows a certain error in the determination of the periods, but not, I believe, as great as they suppose. Except in a few species—as Anis and Pauraques—eggs are normally laid before the middle of the morning. Hence, if the nest be visited once each day, after 11 A. M.—or better, in the afternoon—there is little room for doubt as to the dates when the eggs were laid. Nestlings as a rule leave the nest during the early hours of the morning, seldom in the afternoon, unless frightened by the observer. Although eggs may hatch at all hours of the day, recently I have begun to suspect that the majority of them hatch during the early forenoon. Since the last sentence was written, I have found confirmatory evidence in a study of the Yellow Warbler by F. G. Schrantz (1943), who states that of 119 eggs, only nine hatched during the afternoon, the remaining 110 at night or in the early morning. Might there not be a diurnal periodicity in hammering at the shell by the birdling within, similar to the periodicity in such activities as feeding, singing, and nest-building, which many birds exhibit? Or does the constant application of warmth during the night, instead of the intermittent heating that the eggs receive during the day when only one parent incubates, influence the time of hatching? Because of the tendency for eggs to be laid and to hatch, and for the young to depart, during the morning, it seems probable that incubation and nestling periods might in fact be approximately whole days more often than would be possible if these events occurred at random hours. This subject deserves further study.

Be this as it may, I have calculated the periods to the nearest whole day; for although I have from the first made a practice of visiting nests late in the day, in my earlier records I did not as a rule set down the hour. For example, if the last egg was laid between my visits on the first and second of the month, and the last nestling hatched between the visits on the thirteenth and fourteenth, the incubation period would be given as twelve days. Where visits were more widely spaced, or made early in the morning, allowance is made in the statement of the results (*e. g.* "12 or 13 days").

It is necessary to distinguish clearly between nestling and fledging periods. The nestling period, as given in the following list, is the interval between the hatching of the young bird and its departure from the nest. Usually the second is an event no less definite in time than the first; with patient watching, we would be able to give the minute of the departure of the nestling. Most of the birds treated here do not return to the nest once they have severed contact with it. A few, among them woodpeckers and wrens, may use their nests as dormitories and return to them in the evening, along with one or both parents; but after their first departure they are away most of the day, and are clearly no longer nestlings. Rarely a young bird, of a kind that does not sleep in a dormitory, will return to its nest after a brief venture beyond it; but this behavior is, in my experience, exceptional, and not often repeated. If alarmed, anis, Hoatzins, and a few other birds scramble out of the nest before they are feathered, and return later if they can reach it; but the great majority of altricial birds do not return even if prematurely frightened out; often they can not be made to stay in the nest, even if replaced by a well-intentioned bird-watcher.

"To fledge" is defined in Webster's Collegiate Dictionary (5th Edition) as "to acquire the feathers necessary for flight." Many ground-nesting altricial birds, as Skylarks and Song Sparrows, may quit the nest before they can fly, hence their fledging period is longer than their nestling period. Woodpeckers, swallows, and numerous other birds, especially those that are reared in high nests and in holes, are well able to fly—as we can prove by driving them prematurely into the open—days before they normally leave the nest and spread their wings. Their fledging period is shorter than their nestling period. The fledging period is more difficult to determine than the nestling period, not only from the circumstance that the bird may wander out of sight before it can fly, but because flight is a relative thing. Is it correct to say that a bird is fledged when it can merely flutter

a few yards on a descending course, as many do when they leave the nest? Even precocious birds—as tinamous and quail—have a nestling period, although often of less than a day's duration.

The accurate determination of the true nestling period—the age of spontaneous departure—is no easy matter. If we are careless, we may frighten the little bird prematurely from the nest. I believe it impossible to determine the true nestling period if we remove the young birds, after they begin to be feathered, for weighing, description of plumage, photography, or the like. Where sufficient nests are available, we should reserve some for these purposes, while in others the nestlings remain quite untouched, to learn the age at which they spontaneously depart. If one is consistent in handling the nestlings, in various nests of the same species, he will find that they all depart at more or less the same age; but this will be the age at which the fear-reaction changes from crouching down in the nest to the attempt to escape from it, not the true nestling period. The interval between the age at which nestlings depart when frightened and that at which they depart spontaneously represents a margin of safety in their lives; if undisturbed, they are certainly safer in the nest until more mature; but if their lives are threatened by a predator, it is better for them to scatter and take their chances in the open.

Many recorded nestling periods are almost certainly too short. With some species, as the Gray-capped Flycatcher, I found that the more care I took to avoid frightening the nestlings, the longer they remained in the nest; for contrary to a general impression, parent birds do not, as a rule, urge their youngsters to depart. The use of a mirror, attached to the end of a long stick if need be, will often show whether the nestlings are still at home, without alarming them by coming too near, or shaking the surrounding foliage. Some of my early records of nestling periods are too short, because I did not take all necessary precautions, or had removed the youngsters for photography. I have indicated such cases in the following list. The nests of some tropical birds—as spine-tails, certain flycatchers, etc.—are of such shape that it is practically impossible to see whether the nestlings are still within, without disturbing them to the extent that they may be driven out if they have not already departed. The only alternative course is to learn by watching for the parents to come with food whether the nest is still occupied.

In calculating the nestling periods, I have followed a different procedure than for the incubation period. An egg is not necessarily incubated as soon as laid; but a nestling grows older from the moment

it hatches. When nestlings do not all depart on the same day, I assume that they quit the nest in the order of their age. This must normally be true. But even if this assumption be contrary to fact, the calculations based upon it will give a mean value for the length of the nestling period. For example, if in a nest with two eggs these hatch on the first and second of the month, and the nestlings depart on the 20th and 21st, the nestling period for each would be nineteen days. But if in fact they left in the inverse order of their age—which would not be discovered unless they had been marked as hatched, a difficult matter—their periods were twenty and eighteen days, respectively. Nineteen days is the average value; while we must depend upon observations at a number of nests to give the range of variation.

In a number of instances, the approximate nestling period was determined at nests of woodpeckers, toucans, becards, etc., far out of reach, by noting the date when food was first brought, then watching for the departure of the fledglings. Since the very first food brought to the newly hatched nestlings is apt to escape detection, from being in very small particles held inside the parent's bill, this method is likely to give too short, rather than too long, a period.

In ornithology, no less than in physics, the validity of a numerical result depends upon the number of observations on which it rests. Hence I have thought it desirable to give the incubation and nestling periods of every egg and nestling for which I have been able to determine them. In the following list, the notation "12, 12, 12 (3)" means that in a nest with three eggs, three hatched on the twelfth day after the last was laid. Since, when the eggs have not been marked, one can not be certain that the last has hatched unless *all* have hatched, I have thought it worth while to indicate between the parentheses how many produced nestlings. When the number that hatched is greater than the number of periods given, it will be understood that the others hatched a day or two earlier than the last. So "16, 16 (5, four hatched)" indicates that in a set of five eggs, the last two hatched sixteen days after the set was complete, two more a day or more earlier, and one failed to hatch. While this system of notation may appear a trifle complex, I can think of no more concise mode of presenting all the information which the reader will require in order to judge the exactitude of the determination.

The nestling periods have been calculated as already explained. Here the numerals in parentheses indicate the number of young believed to have left the nest alive.

The size of the egg is one of the factors that have been supposed to influence its incubation period. For a number of the species here treated, egg measurements have apparently never been published; others are to be found in sources so scattered that reference to them would be time-consuming and difficult. Hence I have given the dimensions of the eggs wherever known. The numerals in parentheses indicate the number of measurements upon which the average is based. Since, as already explained, much of my work has been done with mirrors to avoid disturbing the nests, I do not have measurements of all the eggs used in the determination of the incubation periods. In the following list, incubation periods are given for about 90 species of Central American birds, and nestling periods for 120 species. Except where otherwise indicated, the periods are given in days.

Nomenclature, both scientific and vernacular, follows Hellmayr's 'Catalogue of the Birds of the Americas' as far as possible, with little exception. In a few cases substitute vernacular names are proposed parenthetically.

Since some readers may wish to know the localities or regions in which particular data were secured, a letter (in parentheses) has been added after each name in accordance with the following schedule:

(A)—El General, head of Térraba Valley, southern Pacific Costa Rica.
(B)—Costa Rican highlands.
(C)—Carribbean Costa Rica.
(D)—Caribbean Honduras, near Tela.
(E)—Los Amates, humid lower Motagua Valley, Guatemala.
(F)—Guatemalan highlands, Department of Chimaltenango.
(G)—Caribbean Guatemala.
(H)—Western Panamá.
(I) —Almirante, western Panamá.
(J) —Canal Zone.

TINAMIDAE. Tinamous.

Crypturus soui modestus, Cabanis's Pileated Tinamou. (A)
Eggs (14) 43.3 × 32.4 mm.
Left nest less than one day after hatching (1 chick).

PHASIANIDAE. Partridges, Quails, Pheasants.

Odontophorus gujanensis castigatus, Chiriquí Partridge. (A)
Eggs (4) 39.1 × 27.6 mm.
Incubation: between 24 and 28 days (4, all hatched).
Nestling: 20 hours or less (4).

COLUMBIDAE. Pigeons and Doves.

Columbigallina talpacoti rufipennis, Red-winged Talpacoti Dove. (A)
Eggs (16) 23.2 × 17.1 mm.

Incubation: 13, 13 (2); 13, 13 (2); 12, 12 (2); 12, 12 (2).
Nestling: 14, 14 (2); 12, 12 (2); 12 (1).

Leptotila verreauxi verreauxi, Verreaux's White-fronted Dove. (A)
Eggs (7) 29.3 × 22.1 mm.
Nestling: 14, 15 (2).

Oreopeleia montana montana, Ruddy Quail Dove. (A)
Eggs (6) 28.1 × 20.4 mm.
Incubation: 10, 10 (2).
Nestling: 10, 10 (2). As I approached the nest, I found the mother sitting beside the ten-day-old nestlings. She took flight and they followed, flying well until out of sight among the underwood.

RALLIDAE. Rails, Gallinules, Coots.

Creciscus ruber, Red Rail. (D)
Eggs (14) 31.0 × 23.5 mm.
Nestling: 14 hours, little over 1 day (3); 1 day (3).

Ionornis martinica, Purple Gallinule. (J)
Eggs (5) 38.7 × 28.2 mm.
Nestling: 1 or 2 days (4).

CATHARTIDAE. New World Vultures.

Coragyps atratus, Black Vulture. (E)
Nestling: At least 70 days (1). The nestling did not always remain on the same spot on the ground, but wandered along trails it had made through the surrounding pasture grass.

ALCEDINIDAE. Kingfishers.

Chloroceryle amazona, Amazon Kingfisher. (D, E)
Eggs (7) 31.5 × 27.1 mm.
Incubation: 22, 22 (3, all hatched).
Nestling: not less than 29 (4).

Megaceryle t. torquata, Ringed Kingfisher. (E)
Eggs (8) 45.4 × 32.6 mm.
Nestling: between 33 & 35 days (1); between 35 & 38 days (1).

MOMOTIDAE. Motmots.

Aspatha gularis, Blue-throated Green Motmot. (F)
Eggs (11) 28.8 × 22.8 mm.
Incubation: 21 or 22 (3, all hatched); 21, 21, 21 (3); 21 (3, all hatched).
Nestling: 30, 30, 31 (3); 30, 29 (3); 31 (2).

Eumomota superciliosa bipartita, Green-breasted Turquoise-browed Motmot. (D, E)
Eggs (15) 26.5 × 22.5 mm.
Nestling: 28 (4, nestlings handled); 26, 26 (3, nestlings handled). At the age of 26 or 28 days they flew well, but would doubtless have remained longer in the burrow had they not been removed for photography.

CAPRIMULGIDAE. Pauraques, Nighthawks, Whippoorwills.

Nyctidromus a. albicollis, Pauraque. (B)
Nestling: The downy young, less than a day old, may be called by the parents to a position some yards distant from the spot on the ground where they hatched. After they are a few days old, it is difficult to follow their movements.

TROCHILIDAE. Hummingbirds.

Amazilia t. tzacatl, Rieffer's Hummingbird. (D, H)

Eggs (6) 14.0 × 8.8 mm.

Incubation: 16 (2, both hatched); 16, 16 (2); 16 (2, 1 hatched); 15 (2, both hatched).

Nestling: 19, 19 (2, disturbed); 18, 19 (2, disturbed); 19, 20 (2, nest collapsed); 21, 22 (2, disturbed).

Callipharus nigriventris, Black-bellied Hummingbird. (B)

Incubation: At least 16 (2, both hatched).

Colibri cyanotus, Lesser Violet-ear. (B)

Incubation: 16, 16 (2).

Hylocharis, l. leucotis, White-eared Hummingbird. (F)

Eggs (6) 12.5 × 8.0 mm.

Nestling: 26 (1); 23, 26 (2).

Oreopyra castaneoventris calolaema, Costa Rican Mountain Gem. (B)

Nestling: 23 (1); 23, 23 (2).

Phaethornis adolphi saturatus, Dusky Hermit. (A)

Incubation: 16 (2, both hatched).

TROGONIDAE. Trogons, Quetzals.

Pharomachrus mocinno costaricensis, Costa Rican Quetzal. (B)

Eggs (1) 38.9 × 30.2 mm.

Incubation: 17 or 18 (2, both hatched).

Nestling: At least 29 (2); about 31; 23, 23 (2, in an unusually low nest, removed for photography).

Trogon bairdii, Baird's Trogon. (A)

Eggs (2) 33.3 × 25.4 mm.

Nestling: 25 (1).

Trogon curucui tenellus, Graceful Trogon. (A)

Eggs (5) 27.7 × 22.7 mm.

Incubation: 18 (2, one hatched).

Trogon m. melanocephalus, Black-headed Trogon. (E)

Eggs (2) 30.4 × 22.8 mm.

Incubation: at least 19 (3, one hatched).

Nestling: 16 or 17, thrice (3).

Trogon mexicanus, Mexican Trogon. (F)

Eggs (6) 28.9 × 23.5 mm.

Incubation: 19, 19 (2); 18 (2, one hatched).

Nestling: 15, 16 (2); 14 or 15 (1).

CUCULIDAE. Cuckoos, Anis.

Crotophaga ani, Smooth-billed Ani. (J)

Eggs (9) 37.6 × 26.4 mm.

Incubation: 15 or less (9, three hatched). Davis (1940) gives the incubation period of Cuban birds as "about 13 days," range 13 to 15 days.

Nestling: 7 (1). See remarks under following species.

Crotophaga s. sulcirostris, Groove-billed Ani. (D)

Eggs (56) 32.1 × 24.2 mm.

Incubation: 14, 14 (3, eggs marked, two hatched, including last of set); 13, 13, 13 (4, of which last three hatched, all on same day). These periods are calculated from laying to hatching of the last egg. Since these anis were slow in beginning to incubate, the eggs were actually warmed for about 12 days before they hatched.

Nestling: 10, 10 (2); 9 (3). Young anis of both species climb from the nest if alarmed at the age of five or six days, before they are feathered; but when possible, they return to be brooded in the nest until a week old, and linger in the nest tree until 9 or 10 days old.

RAMPHASTIDAE. Toucans, Araçaris.

Aulacorhynchus c. caeruleigularis. Blue-throated Toucanet. (B)

Incubation: 16 (3, all hatched).

Nestling: at least 43 (2).

Pteroglossus t. torquatus, Collared Aracari. (J)

Nestling: at least 44 (at least 2).

Ramphastos piscivorus brevicarinatus, Short-keeled Toucan. (J)

Nestling: Van Tyne (1929) estimates the nestling period at 45 days. I should expect that this toucan, which is much larger than the two foregoing species, would remain in the nest somewhat longer.

CAPITONIDAE. Barbets.

Dicrorhynchus frantzii, Costa Rican Prong-billed Barbet. (B)

Incubation: 13, 13, 13, 13, 13 (5).

GALBULIDAE. Jacamars.

Galbula melanogenia, Black-chinned Jacamar. (A, E)

Eggs (4) 22.4 × 19.4 mm.

Incubation: about 20 days (4, all hatched); 20 or 21 (3, all hatched); 22 (2, both hatched; the pair slow in beginning to incubate).

Nestling: 20, 20 (4, handled); 25, 26 (2, not touched); 21, 22 (2, not touched).

PICIDAE. Woodpeckers, Piculets.

Centurus rubricapillus wagleri, Wagler's Woodpecker. (A)

Eggs (1) 23.8 × 17.1 mm.

Nestling: not less than 31 (2).

Centurus aurifrons pauper, Trujillo Woodpecker. (E)

Eggs (4) 22.4 × 19.4 mm.

Incubation: about 13 days (4, three hatched, the first only 11 days after the set was complete).

Nestling: 30 (3).

Dryobates villosus extimus, Boquete Hairy Woodpecker. (Costa Rica)

Nestling: 28 (1).

Piculus rubiginosus uropygialis, Costa Rican Woodpecker. (B)

Nestling: 24 (1, inadvertently frightened from nest, flew well).

Picumnus olivaceus flavotinctus, Veragua Piculet. (A)

Eggs (3) 16.6 × 12.3 mm.

Incubation: 13 or 14 (3, two hatched).

Nestling: 24, 24 or 25 (2).

Tripsurus chrysauchen, Golden-naped Woodpecker. (A)

Nestling: at least 33 (3).

FORMICARIIDAE. Antbirds.

Thamnophilus bridgesi, Bridges's Ant Shrike. (A)

Eggs (2) 23.0 × 16.7 mm.

Incubation: 14 or 15, 14 or 15 (2); 14, 14 (2); 16 (2, one hatched).

Nestling: 10, 10 (2, the first nestling hatched at about 8:50 A. M., June 2, 1937, and departed while I watched from a blind at 6:51 A. M. on June 12, aged 9 days, 22

hours; the second nestling hatched between noon on June 2 and the following dawn, departed at 6:27 A. M. on June 13).

Cercomacra tyrannina crepera, Dusky Tyrannine Antbird. (A)
Egg (1) 19.4 × 14.3 mm.
Nestling: about 11 (2).

Dysithamnus mentalis septentrionalis, Northern Bush Bird (Antvireo). (A)
Eggs (6) 20.0 × 15.0 mm.
Incubation: 15, 15 (2).
Nestling: 9, 9 (2); 9, 9 (2).

Hylophylax n. naevioides, Spotted Antbird. (J)
Eggs (2) 23.0 × 15.5 mm.
Nestling: 11, 11 (2).

Myrmotherula axillaris albigula, Lawrence's Ant Wren. (J)
Eggs (4) 17.2 × 12.5 mm.
Incubation: 16, 16 (2).

Taraba major obscurus, Red-eyed Ant Shrike. (A)
Eggs (4) 29.3 × 22.6 mm.
Incubation: 17 or 18 (2, one hatched).
Nestling: 12 or 13 (1).

Thamnophilus doliatus pacificus, Pacific Ant Shrike. (A)
Eggs (4) 23.3 × 17.2 mm.
Nestling: 12, 13 (2)

Thamnophilus punctatus atrinucha, Slaty Ant Shrike. (J)
Eggs (6) 23.9 × 16.6 mm.
Nestling: 9, 9 (2).

FURNARIIDAE. Ovenbirds and their allies.

Automolus ochrolaemus exsertus, Chiriqui Automolus. (A)
Incubation: 18 to 20, thrice (3, all hatched).
Nestling: 18, 18, 18 (3).

Pseudocolaptes l. lawrencii, Lawrence's Pseudocolaptes. (B)
Nestling: at least 29.

Synallaxis brachyura nigrofumosa, Sooty Spine-tail (Castle-builder). (A)
Eggs (6) 21.5 × 17.0 mm.
Incubation: 18, 18 (2).
Nestling: 14 or 15, 14 or 15 (2, departure probably premature). It is impossible to see the contents of the nests of Spine-tails without making an opening in the side, which causes disturbances in their routine, and may frighten the nestlings forth prematurely.

Synallaxis erythrothorax, Rufous-breasted Spine-tail (Castle-builder). (D, G)
Eggs (19) 21.1 × 16.7 mm.
Incubation: about 17 (4).
Nestling: 14 or 15 (1, frightened from nest).

Xenops minutus ridgwayi, Ridgway's Xenops. (A)
Incubation: between 15 and 17 (2, both hatched).
Nestling: 13, 14 (2).

DENDROCOLAPTIDAE. Wood-hewers.

Lepidocolaptes affinis neglectus, Southern Allied Wood-hewer. (B)
Nestling: 19, 19 (2); 19, 19 (2).

Lepidocolaptes souleyetii compressus, Thin-billed Wood-hewer. (A)
Incubation: 15 (2, one hatched).

Nestling: 19 (1). A pair of Thin-billed Wood-hewers and a *Dendrocincla anabatina saturata* built in the same hollow palm trunk. Two eggs were laid, and incubated by the *Dendrocincla*, which hatched one and faithfully attended the nestling. As it grew older, its streaked head and soft trill clearly indicated that it was not her own offspring.

TYRANNIDAE. Tyrant Flycatchers.

Elaenia c. chiriquensis, Lawrence's Elaenia. (A)
Eggs (13) 18.5 × 14.5 mm.
Incubation: 15 (1); 15 (2, one hatched); 15 (2, one hatched); 14, 14 (2); 14 (2, both hatched); 14 (2, one hatched); 14 (1).
Nestling: 15 or 16 (1); 15 or 16, 16 (2); 14 (1, frightened); 15 (1); 15, 15 (2).

Elaenia flavogaster subpagana, Northern Yellow-bellied Elaenia. (A)
Eggs (15) 21.1 × 16.4 mm.
Incubation: 15 or 16 (2, both hatched); 16 (2, both hatched); 15 (2, both hatched); 17 (2, both hatched; the nest was above a frequently-used path, and the sitting bird was often disturbed); 17 (2, one hatched).
Nestling: 17 or 18 (1); 17 (1).

Legatus l. leucophaius, Striped Flycatcher. (A)
Eggs (8) 21.9 × 16.5 mm.
Incubation: 16, 16 (3, all hatched).
Nestling: 19, 20 (2); 19, 18, 18 (3).

Megarhynchus pitangua mexicanus, Mexican Boat-billed Flycatcher. (A)
Incubation: about 18 (2).
Nestling: at least 23 (1); 24, 24, 24 (3).

Myiarchus tuberculifer connectens, Matagalpa Flycatcher. (E)
Eggs (8) 20.0 × 15.0 mm.
Nestling: 13, 13, 14 (3, left prematurely, but flew well).

Myiobius a. atricaudus, Black-tailed Myiobius. (A)
Eggs (2) 17.3 × 13.1 mm.
Incubation: about 23 days (1).

Myiobius sulphureipygius aureatus, Southern Sulphur-rumped Myiobius. (A)
Eggs (4) 18.3 × 13.1 mm.
Incubation: 22, 22 (2).
Nestling: 22, 22 (2).

Myiochanes cinereus brachytarsus, Short-legged Pewee. (C)
Eggs (2) 17.1 × 13.5 mm.
Incubation: 15 (3, two hatched).

Myiodynastes luteiventris, Sulphur-bellied Flycatcher. (E)
Eggs (3) 25.5 × 19.1 mm.
Incubation: 16 (3, all hatched).

Myiodynastes maculatus nobilis, Noble Flycatcher. (A, J)
Eggs (3) 27.7 × 18.6 mm.
Incubation: 16 or 17 (3, all hatched).
Nestling: at least 21 (3).

Myiophobus fasciatus furfurosus, Bran-colored Flycatcher. (A)
Eggs (12) 17.3 × 13.0 mm.
Incubation: 17, 17 (2); 17 (2, one hatched); 17, 17 (2).
Nestling: 17 (1); 15 (1); 16, 16 (2).

Myiozetetes g. granadensis, Gray-capped Flycatcher. (A)
Eggs (15) 23.9 × 17.3 mm.

Incubation: 16 (3, all hatched); 17, 17, 17 (3); 16 (3, all hatched); 18, 18 (2); 16, 16, 16 (3); 16, 16, 16 (3); 16, 16, 16 (3); 16 (3, all hatched); 31 or 32 (3; I am at a loss to explain this); 16 (3, last hatched); 17, 17 (2); 16, 16, 16 (3); 16, 16 (3, last two hatched).

Nestling: 19, 19, 20 (3); 20, 20 (2); 21, 21 (3); 20, 20, 20 (3); 19, 19 (2); 21, 21 (3); 20, 20 (2).

Myiozetetes similis columbianus, Colombian Vermilion-crowned Flycatcher (Chipsa-cheery Flycatcher). (A, I)

Eggs (11) 23.5 × 16.7 mm.

Incubation: 15, 15 (3, two hatched); 16 (3, one hatched); 15, 15, 15 (3); 16 (2, last hatched).

Nestling: 17, 17, 17, 16 (4, frightened); 22 (1, departure spontaneous); 20 (1, departure spontaneous).

M. s. texensis, Giraud's Flycatcher. (D)

Nestling: 16 (3, frightened).

Onychorhynchus mexicanus fraterculus, Colombian Royal Flycatcher. (A)

Eggs (4) 19.7 × 14.8 mm.

Incubation: 22, 22 (2).

Nestling: 21, 21 (2); 21 or 22 (2).

O. m. mexicanus, Mexican Royal Flycatcher. (D)

Nestling: 21 (1); 21 or 22 (1).

Pipromorpha oleaginea dyscola, Costa Rican Pipromorpha.

Eggs (7) 20.3 × 14.5 mm.

Incubation: 20 (3, all hatched); 19, 19, 19 (3); 21 (3, all hatched).

Nestling: 19, 19, 19 (3, frightened from nest perhaps a trifle prematurely, but flew well).

P. o. assimilis, Mexican Pipromorpha. (D)

Nestling: 18 (1, handled).

Platyrinchus coronatus superciliaris, Western Golden-crowned Flat-bill (Lawrence's Spade-billed Flycatcher). (A)

Eggs (6) 16.1 × 13.3 mm.

Nestling: 15, 16 (2).

Rhynchocyclus b. brevirostris, Short-billed Flat-bill. (A)

Nestling: about 23 (1).

Serpophaga cinerea grisea, Lawrence's Serpophaga (Black-hooded Flycatcher). (Costa Rica)

Eggs (2) 16.9 × 12.7 mm.

Incubation: 17 (2, both hatched); 18 (2, one hatched).

Nestling: 17 (1).

Terenotriccus erythrurus fulvigularis, Fulvous-throated Flycatcher. (J)

Eggs (4) 15.8 × 11.8 mm.

Incubation: at least 22 (2, both hatched).

Nestling: 19 (1).

Todirostrum cinereum finitimum, Northern Tody-tyrant. (I)

Eggs (2) 15.9 × 11.3 mm.

Incubation: 18, 18 (2); 18 (3, all hatched); 17 (3, all hatched).

Todirostrum sylvia schistaceiceps, Slaty-headed Tody-tyrant. (A)

Eggs (4) 17.5 × 12.7 mm.

Incubation: 19, 19 (2).

Nestling: 21, 21 (2); at least 19 (2).

Tolmomyias sulphurescens cinereiceps, Gray-headed Flat-bill. **(A)**
Eggs 20.8 × 14 mm. (Carriker).
Nestling: at least 20.
Tyranniscus vilissimus parvus, Lesser Paltry Tyrannulet **(Lesser Tyranniscus). (A)**
Eggs (1) 16.7 × 13.1 mm.
Incubation: 16 (2, both hatched).
Nestling: 18 (1); 19, 18 or 19 (2).
Tyrannus melancholicus chloronotus, Berlepsch's Kingbird. **(A)**
Eggs (12) 24.7 × 18.2 mm.
Incubation: at least 16 (3, two hatched); 16 (3, all hatched).
Nestling: 18 or 19 (1).

PIPRIDAE. Manakins.

Manacus aurantiacus, Salvin's Manakin. (A)
Eggs (10) 20.6 × 14.9 mm.
Nestling: at least 17 (1).
Pipra coronata velutina, Velvety Manakin. (A)
Eggs (4) 18.6 × 14.2 mm.
Incubation: 19, 19 (2).

COTINGIDAE. Cotingas, Becards.

Pachyramphus c. cinnamomeus, Cinnamon Becard. (C)
Nestling: at least 20 days.
Pachyramphus polychopterus similis, Slate-bellied Becard. **(A)**
Eggs (2) 20.0 × 14.7 mm.
Incubation: 18 or 19 (4, three hatched).
Platypsaris aglaiae sumichrasti, Sumichrast's Becard. **(F)**
Eggs (1) 25.4 × 17.5 mm.
Nestling: at least 19.
Tityra inquisitor fraserii, Fraser's Tityra. (C)
Nestling: at least 25 (3, in nest far out of reach).
Tityra semifasciata costaricensis, Costa Rican Tityra. **(A)**
Eggs (2) 30.0 × 21.0 mm.
Nestling: at least 21 days.

HIRUNDINIDAE. Swallows and Martins.

Pygochelidon c. cyanoleuca, Blue-and-white Swallow. **(Costa Rica)**
Incubation: 15, 15, 15 (3); 15, 15 (3, all hatched).
Nestling: 26, 27 (3).
Stelgidopteryx ruficollis fulvipennis, Salvin's Rough-winged Swallow. **(C, G)**
Eggs (27) 19.8 × 13.6 mm.
Incubation: 16, 16, 16 (5, three hatched); 18 (5, all hatched).
Nestling: 20 or 21 (4).

SYLVIIDAE. Gnatcatchers, European Warblers.

Polioptila plumbea superciliaris, Lawrence's Gnatcatcher. **(A)**
Incubation: 13, 13, 13 (3).
Ramphocaenus r. rufiventris, Northern Long-billed Antwren. **(A)**
Eggs (2) 19.5 × 13.9 mm.
Incubation: 17 (2, both hatched).
Nestling: 12, 12 (2).

TROGLODYTIDAE. Wrens.

Heleodytes z. zonatus, Mexican Banded Wren. (F)
Eggs (10) 22.0 × 15.8 mm.
Nestling: 18, 18, 19 (3).

Henicorhina leucophrys collina, Chiriqui Wood Wren. (B)
Eggs (2) 22.2 × 15.5 mm.
Incubation: 19 or 20 (2, both hatched).
Nestling: 14, 14 (2); 17, 18 (2).

Thryophilus m. modestus, Cabanis's Wren (Chinchirigüí Wren). (A)
Eggs (6) 22.3 × 15.6 mm.
Incubation: 18 (2, both hatched).
Nestling: 13 (2, frightened).

Thryothorus nigricapillus semibadius, Salvin's Wren (River Wren). (A)
Eggs (3) 21.5 × 15.4 mm.
Nestling: 16 (1, frightened).

Thryothorus rutilus hyperythrus, Tawny-bellied Wren. (A)
Eggs (3) 18.2 × 13.8 mm.
Nestling: 16, 16, 16 (3).

Thryothorus rutilus petersi, Honduras Spotted-breasted Wren. (D)
Eggs (2) 19.1 × 15.3 mm.
Nestling: 12 (2, nestlings handled).

Troglodytes musculus inquietus, Panamá House Wren. (F)
Eggs (9) 17.5 × 13.4 mm.
Incubation: 15, 15 (4, three hatched); 15, 15, 15 (4, three hatched); 16, 16 (4, two hatched); 16 (4, all hatched); 15 (4, all hatched).
Nestling: 18, 18, 18 (3); 18, 18, 18 (3); 18 (1); 17, 16, 16, 15 (4, frightened); 18, 18, 18, 17 (4, all left spontaneously within space of 4 hours, 40 minutes).

Troglodytes m. intermedius, Costa Rica House Wren. (A)
Incubation: 17, 17, 17 (4, all hatched); 15 (3, two hatched).
Nestling: 18, 18, 18, 19 (4); 18, 18, 18, 17 (4); 18, 19 (2).

MIMIDAE. Mockingbirds, Thrashers.

Melanotis caerulescens hypoleucus, White-breasted Blue Mockingbird. (F)
Eggs (8) 31.6 × 21.5 mm.
Nestling: 14, 15 (2, nestlings handled).

TURDIDAE. Thrushes, Bluebirds.

Catharus g. griseiceps, Gray-headed Nightingale-Thrush. (A)
Eggs (23) 23.7 × 17.6 mm.
Incubation: 13, 13 (2); 15, 15 (2); 13, 13 (2); at least 15 (2, one hatched); 15 (2, one hatched).
Nestling: 14 or 15, 14 or 15 (2); 15 (1); 17, 17 (2); 14, 13 (2); 15, 15 (2).

Catharus occidentalis alticola, Guatemalan Nightingale-Thrush. (F)
Eggs (12) 23.9 × 18.2 mm.
Incubation: 15 or 16 (2, both hatched); 15, 15 (2).
Nestling: 14, 15 (2); 15 or 16, 15 or 16 (2).

Myadestes ralloides melanops, Black-faced Solitaire. (B)
Eggs (3) 25.5 × 19.1 mm.
Incubation: 12 or 13, 12 or 13, 12 or 13 (3).
Nestling: 16, 16, 16 (3).

Sialia sialis guatemalae, Guatemala Bluebird. (F)
Eggs (8) 22.1 × 16.8 mm.
Incubation: 14 (4, one hatched).
Turdus grayi subspp., Gray's Thrush. (A, D–H)
Eggs (22) 28.3 × 20.2 mm.
Incubation: 12, 12, 12 (3); 12 (3, all hatched); 12 (3, all hatched).
Nestling: at least 15 (3); 15, (2); 15 (1); 16, 16 (2); 15 (1); 15 (2).

VIREONIDAE. Vireos.

Pachysylvia o. ochraceiceps, Tawny-crowned Pachysylvia. (A)
Nestling: at least 13 (2).
Vireo virescens insulanus, Southern Yellow-green Vireo. (A)
Eggs (8) 20.5 × 14.7 mm.
Incubation: 14, 14 (2); 14 (3, all hatched); 13, 13, 13 (3).
Nestling: 13, 14 (2); 13, 13 (3); 12 (1); 12, 12, 12 (3; they hatched between 6:00 and 8:23 A. M., May 9, 1943, and departed spontaneously between 6:00 and 6:30 A. M., May 21).

PARIDAE. Titmice, Chickadees, Bush-tits.

Psaltriparus minimus melanotis, Black-eared Bush-tit. (F)
Incubation: 15, 15 (4, all hatched); 15 or 16 (4, all hatched).
Nestling: 17, 17, 18, 18 (4); 17 or 18 (4); 19, 19, 19, 19 (4).

COMPSOTHLYPIDAE. Wood Warblers.

Basileuterus fulvicauda veraguensis, Veraguan Buff-rumped Warbler. (A)
Eggs (10) 21.4 × 15.1 mm.
Incubation: 16, 16 (2); 16 (2, one hatched); 16, 16 (2); 19 (2, one hatched; bird frequently frightened from nest in roadside bank); 17 (2, one hatched; nest in same position as last, a year later; the road now less often used); 17 (2, both hatched); 16, 16 (2).
Nestling: 15 (1); 14, 14 (2); 14, 14 (2); 13, 13 (2).
Ergaticus ruber versicolor, Pink-headed Warbler. (F)
Eggs (9) 17.1 × 13.3 mm.
Incubation: 16, 16, 16 (3).
Nestling: 11, 11, 11 (3, handled); 10, 10 (2, frightened).
Myioborus miniatus aurantiacus, Orange-bellied Myioborus (Orange-bellied Redstart). (B)
Eggs (20) 17.5 × 13.4 mm.
Incubation: 14, 14, 14 (3); 13, 13, 13 (3); 15, 15 (3, two hatched); 15, 15 (2); 15, 15, 15 (3); 15, 15 (3, two hatched).
Nestling: 14, 14 (2); 12, 12 (2); 12, 12, 12 (3); 12 (1); 10, 10 (2, probably left prematurely because they had been removed from the nest for examination).
Myioborus miniatus connectens, Intermediate Myioborus (Intermediate Redstart). (F)
Eggs (3) 17.5 × 13.4 mm.
Nestling: 11 (2, nestlings handled).
Myioborus torquatus, Collared Myioborus (Collared Redstart). (B)
Eggs (5) 18.7 × 13.5 mm.
Incubation: 15, 15, 15 (3).
Nestling: 13, 13 (2).

FRINGILLIDAE. Finches, Sparrows, Grosbeaks.

Arremonops conirostris richmondi, Richmond's Sparrow. (A)
Eggs (13) 25.5 × 18.3 mm.
Incubation: at least 14 (2, both hatched); at least 14 (2, both hatched).
Nestling: 12 (2); 11, 11 (2); 11 or 12 (2).

Atlapetes gutturalis parvirostris, Costa Rican Yellow-throated Atlapetes. (B)
Eggs (9) 23.7 × 17.9 mm.
Nestling: 12 (1); 12 (3).

Atlapetes torquatus costaricensis, Costa Rican Atlapetes. (A)
Eggs (12) 25.7 × 18.5 mm.
Incubation: 15, 15 (2); 15 (2, both hatched).
Nestling: 13 (1); 9, 10 (2, frightened).

Oryzoborus funereus, Lesser Rice Grosbeak. (I)
Incubation: 12, 12 (2).
Nestling: between 10 and 12 (1).

Pselliophorus tibialis, Yellow-thighed Sparrow. (B)
Eggs (4) 24.8 × 18.2 mm.
Nestling: 12, 12 (2).

Saltator coerulescens grandis, Lichtenstein's Saltator. (D)
Eggs (3) 25.6 × 18.7 mm.
Nestling: 15 (1).

Saltator maximus intermedius, Panamá Buff-throated Saltator. (A)
Eggs (15) 27.3 × 19.1 mm.
Incubation: 13, 13 (2); 13 (2, one hatched); 16 (2, one hatched; female kept off nest by a rival).
Nestling: 15 (1); 13 (1); 14 (1); 13 (1); 15 (1).

Saltator albicollis furax, Costa Rican Streaked Saltator. (A)
Eggs (9) 26.1 × 18.0 mm.
Nestling: 13 (1).

Sporophila aurita aurita, Hicks's Seed-eater. (A)
Eggs (8) 17.3 × 13.1 mm.
Incubation: 12, 12 (2).
Nestling: 13, 13 (2); 11, 12 (2); 13, 13 (2); 13, 13 (2).

Sporophila aurita corvina, Black Seed-eater. (C)
Eggs (6) 18.0 × 13.2 mm.
Incubation: 12, 12, 12 (3).
Nestling: 12, 12, 12 (3)

Sporophila torqueola morelleti, Morellet's Seed-eater. (D)
Eggs (13) 16.3 × 12.7 mm.
Incubation: 13 (2, both hatched).
Nestling: 10 or 11 (2); 11, 11 (2).

Tiaris olivacea pusilla, Mexican Grassquit. (Costa Rica)
Eggs (5) 17.0 × 12.9 mm.
Incubation: 13, 13 (3, two hatched); 16, 16, 16 (3); 13, 13 (3, all hatched); 13 (3, all hatched); 13, 13 (2, the second egg was laid before 6:00 A. M., June 26, 1943, and hatched between 5:32 and 6:18 A. M., July 9, giving an incubation period of almost exactly 13 days); 13, 13 (2).
Nestling: 10 (1, departure probably premature); 14, 14 or 15 (2); 14, 14, 13 (3); 15, 15 (2); 13 ,13 (2).

Zonotrichia capensis costaricensis, Costa Rican Sparrow. (B)
Nestling: 12 (1).
Zonotrichia capensis septentrionalis, Guatemalan Sparrow. (F)
Eggs (12) 20.8 × 15.6 mm.
Nestling: 10, 10 (2).

COEREBIDAE. Honeycreepers.

Coereba flaveola mexicana, Mexican Bananaquit. (J)
Incubation: 13 (2, both hatched); 13, 13 (2); 12, 12 (2).
Nestling: 17, 17 (2); 17, 17 (2); 16 or 17 (2).
Cyanerpes cyaneus carneipes, Flesh-legged Honey Creeper. (A)
Incubation: 12, 12 (2); 13 (2, one hatched); 12 (2, both hatched).
Nestling: 14, 14 (2).
Diglossa baritula plumbea, Costa Rican Diglossa (Costa Rican Flower-piercer). (B)
Eggs (4) 17.0 × 12.7 mm.
Incubation: 14 (2, both hatched).
Nestling: 13, 16 (2, the first frightened from the nest).

THRAUPIDAE. Tanagers, Euphonias.

Chlorophonia occipitalis callophrys, Costa Rican Chlorophonia. (B)
Nestling: not less than 23 (3); 24 or 25 (3).
Eucometis penicillata stictothorax, Streak-chested Tanager. (A)
Eggs (7) 23.9 × 17.2 mm.
Incubation: 14, 14 (2); 16 (1).
Ramphocelus passerinii costaricensis, Cherrie's Tanager (Song Tanager). (A)
Eggs (18) 24.1 × 17.2 mm.
Incubation: 12 (2, both hatched); 12, 12 (2); 13, 13 (2); 12 (2, one hatched); 13, 13 (2); 13 (2, one hatched); 13 (2, one hatched); 12, 12 (2); 12, 12 (2); 12, 12 (2); 12 (2, both hatched); 12, 12 (2); 12, 12 (2).
Nestling: 12, 13 (2); 11, 11 (2); 12, 12 (2); 12, 12 (2); 12 (1); 13, 13 (2); 12, 12 (2); 12, 12 (2).
Ramphocelus p. passerinii, Passerini's Tanager (Scarlet-rumped Black Tanager). (C, H)
Eggs (8) 24.3 × 17.0 mm.
Incubation: 13 (2, both hatched); 12 (2, both hatched).
Nestling: 11, 12 (2); 11, 11 (2); 11, 11 (2).
Ramphocelus dimidiatus isthmicus, Panamá Crimson-backed Tanager. (J)
Eggs (4) 22.4 × 17.1 mm.
Incubation 12, 12 (2); 12, 12 (2).
Nestling: 10, 11 (2).
Tanagra l. lauta, Bonaparte's Euphonia. (E)
Eggs (5) 16.2 × 12.6 mm.
Incubation: 16, 16, 16, 16, 16 (5).
Nestling: 17, 17, 17 (3, nestlings handled).
Tanagra luteicapilla, Yellow-crowned Euphonia. (A)
Eggs (3) 17.2 × 12.8 mm.
Incubation: 13 or 14 (2, both hatched).
Nestling: 24 (1); 22, 22 (2).
Tangara gyrola bangsi, Bangs's Green Tanager. (A)
Eggs (2) 20.4 × 14.1 mm.

Incubation: 13, 13 (2); 14 (2, both hatched).

Nestling: 16, 16 (2); 15 or 16 (2).

Tangara icterocephala, Silver-throated Tanager. (A)

Eggs (6) 21.5 × 15.6 mm.

Incubation: 14, 14 (2).

Tangara nigro-cincta fanny and *T. n. franciscae*, Fanny's Tanager and Francisca's Tanager. (A, J)

Eggs (10) 20.1 × 14.9 mm.

Incubation: 13, 13 (2); 15 (1); 14, 14 (2, the second egg was laid before 6:30 A. M., May 3, 1943, and hatched about 8:45 A. M., May 17).

Nestling: 12, 12 (2, frightened from nest); 13 or 14, 13 or 14 (2, frightened from nest); 14, 14 (2); 15 (1).

Thraupis episcopus diaconus, Northern Gray Tanager. (A)

Eggs (16) 22.9 × 16.0 mm.

Incubation: 14, 14 (2); 14 (2, one hatched); 13 (1); 14 (2, both hatched); 13, 13 (2); 14 (2, both hatched).

Nestling: at least 16 (2); 20, 20 (2); 17, 17 (2); 14, 15 (2, frightened from nest); 17 (1); 18 or 19 (2); 17 or 18 (1); 17, 18 (2).

ICTERIDAE. Orioles, Oropéndolas, Grackles and their allies.

Cassidix m. mexicanus, Great-tailed Grackle. (E)

Eggs (62) 33.6 × 23.0 mm.

Incubation: 13, 13 (2); 14 (3, all hatched); 13 (3, all hatched); 14 (2, both hatched); 13, 13 (2); 13, 13 (3, eggs marked, last two hatched).

Nestling: at least 21 (3); 22, 23, 23 (3); 21 (3). These nestlings were raised in the crowns of coconut palms; at the age of about 16 days, before they could fly, if disturbed they would leave the nest and scramble over the neighboring fronds.

Gymnostinops montezuma, Montezuma Oropéndola.

Nestling: about 30 days.

Icterus m. mesomelas, Yellow-tailed Oriole. (E)

Eggs (3) 23.9 × 17.9 mm.

Incubation: 14 (3, eggs marked, first and third hatched).

Nestling: 12 or 13 (2).

Zarhynchus wagleri ridgwayi, Pale-naped Oropéndola. (J)

Nestling: about 34–37 days (Chapman, 1928).

CORVIDAE. Jays, Crows, Ravens.

Psilorhinus mexicanus cyanogenys, Central American Brown Jay. (E)

Eggs (7) 34.5 × 24.6 mm.

Incubation: 20 (3, the female sat very inconstantly); 18, 18 (3, eggs marked, the last two hatched).

Nestling: 23, 24 (2).

WHAT FACTORS DETERMINE THE LENGTH OF INCUBATION AND NESTLING PERIODS?

Several theories have been advanced to account for the great diversity in the length of the incubation periods of different species of birds. Bergtold (1917) believed that the higher the taxonomic rank of the bird, the more rapidly its eggs hatched. Worth (1940), char-

acterizing Bergtold's theory as a "vague empiricism," proceeds to demonstrate that the incubation period of an egg is determined primarily by its volume, but may be shortened or lengthened by ecological factors, such as the amount of predation to which the nest is exposed. This ecological correction provides a convenient escape whenever the observed incubation period of an egg does not coincide with that calculated from its volume; for actual studies of nest losses appear to be lacking for most of the species he classifies as of "slow" or "rapid" incubation. Thus hummingbirds, whose minute eggs hatch far more slowly than we should expect from their volume, fall among the species with "slow" incubation. Yet studies of several kinds of hummingbirds (Skutch, in Bent, 1940) revealed that they lose a high percentage of their nests. We still have far too little precise information on this subject to allow ourselves the luxury of becoming dogmatic!

I believe that taxonomic position, no less than size of egg and ecological factors, influences the length of the period of incubation. Taxonomic position would cover the varying temperatures at which eggs are incubated, for different groups of birds vary in their average body temperature, and in general this increases with taxonomic rank (Wetmore, 1921). Another factor, which apparently has never been considered, is the number of hours each day during which the eggs are actually warmed. Many kinds of birds, among them species of woodpeckers, pigeons, trogons, antbirds, etc., keep their eggs almost constantly covered, day and night, while a number of small flycatchers, swallows, etc., incubate their eggs only about fifty per cent of the day, taking many short sessions separated by brief recesses. Unpublished studies of about a hundred species show that the great majority of birds which incubate alone spend from sixty to eighty per cent of the day in the nest.

On the whole, the song-birds (Oscines) have the shortest incubation periods, while birds at the foot of the taxonomic ladder tend to have long periods. This is undoubtedly in part because the 'lower orders' are bigger birds, in part because many of them breed upon islets, on inaccessible cliffs or in holes and burrows, where eggs and young are exposed to fewer dangers than in open nests in the fields, thickets, and forests of continental areas infested with snakes, rodents, and other predators. But we must remember that our linear systems of classification, which attempt to arrange the orders and families of birds according to their degree of evolutionary development or specialization, can not, in fact, present a true picture of avian evolution.

If birds are, indeed, a monophyletic group, then all have an ancestry equally respectable. Some have developed more rapidly in one direction, some in another. We place the song-birds at the top of the ladder because, among other things, their organs of song—a distinctive attribute of birds—are the most perfect. But flight is also an important attribute of birds; and were we to take the development of the organs of flight as our fundamental criterion, we should be obliged to place hummingbirds and swifts in the proud position now occupied by the song-birds.

The pigeons present an excellent example of a family with a low taxonomic position and rapid incubation. The shortest incubation period I have ever determined—as short as any credible incubation period I have seen in print—is that of the Ruddy Quail Dove, whose eggs hatched in ten days. The nest of this dove is a frail platform of sticks and leaves in the undergrowth of the tropical forest, a habitat with such a high degree of predation that I am not likely soon to make a second determination of its incubation period. The eggs, be it noted, are larger than those of many passerine birds with longer incubation periods. The eggs of the Ruddy Ground Dove, a bird of the thickets and clearings where nesting success is somewhat higher, hatch in twelve or thirteen days, which is the incubation period of a number of finches with smaller eggs. The nests of pigeons are so frail and small that the rapid hatching and swift development of the young are at a premium with them. In respect of speed of embryological development, they have evolved far more rapidly than in anatomical structure. Pigeons' eggs, however, are incubated continuously, while few oscinine species sit on the nest more than from sixty to eighty per cent of the day; this may account in part for the unexpectedly rapid development of their embryos.

The influence of taxonomic position upon speed of embryological development may be illustrated by the flycatchers as compared with the tanagers, finches, honeycreepers, and thrushes among which they nest. My nests of the Gray-capped Flycatcher, "Chipsacheery," Lawrence's and Northern Yellow-bellied Elænias, Bran-colored Flycatcher, Berlepsch's Kingbird, and Striped Flycatcher were situated in the same plantations, pastures, dooryard shrubbery and neglected clearings as those of the Northern Gray Tanager, Fanny's and Francisca's Tanagers, Cherrie's Tanager, Flesh-legged Honeycreeper, Mexican Bananaquit, Gray's Thrush, Gray-headed Nightingale-Thrush, and Yellow-green Vireo. Their eggs present the same range in size; their nests are on the average no better concealed and often far more con-

spicuous; they are just as readily accessible; and the birds themselves, although on the whole more demonstrative when their nests are threatened, are no better equipped to defend them. Yet the incubation periods of these flycatchers are consistently longer than those of the song-birds among which they dwell. Apparently the flycatchers—at least the tropical species—have not been able to speed up the development of their offspring to quite the same extent as many of the song-birds.

For the slow incubation of another group of flycatchers, whose periods are in excess of twenty days, no explanation occurs to me except the ecological. Perhaps the most surprising figures in all the foregoing list are those of the incubation periods of the Colombian Royal Flycatcher, the species of *Myiobius,* and the Fulvous-throated Flycatcher. These small forest flycatchers all build pendent nests, attached to a thin dangling aërial root, the swinging extremity of a vine, or a slender drooping branch. By far the strangest of all these nests is that of the Colombian Royal Flycatcher. The structure bears so little resemblance to any bird's nest of northern lands that I stood a considerable time looking at my first Colombian Royal Flycatcher's nest without suspecting what it was. It was only the bird's interest in the long, dangling mass of vegetable fibers that caused me to investigate further; and even then I did not at once find the eggs. This remarkable nest is, in my experience, invariably suspended from the extremity of some pensile vine or slender branch above a shaded watercourse, sometimes where a man may with difficulty reach it from the bank, but more often quite inaccessible to him. A well-made example is four or five feet long and relatively slender, composed of fibrous roots, thread-like flower stalks of *Myriocarpa,* small epiphytic orchids, fern rhizomes, and other vegetable materials. Somewhere about the middle, the tangled mass is forced apart to form the nest-chamber, which is hardly more than an open niche, so shallow that in a windier spot the eggs would be in great danger of rolling out. The reddish-brown eggs, darker in general tone than any other flycatcher eggs I have seen, are, despite their exposed position, far from conspicuous in their shallow pocket in the brown, fibrous mass.

The next itself, swinging in the free air above the waterway, is a most conspicuous object. Remembering how it had deceived me when first I set eyes upon it, I once supposed that it escaped predators by its failure to suggest a bird's nest of typical form. But I have since seen toucans—those insatiable nest-robbers!—examine these nests with intention, and have little doubt that the egg-eaters along the water-

courses where these birds breed know well enough what their nests are. I believe that they escape disastrous visitations, during their long period of occupancy, by being, in fact, inaccessible to snakes, toucans, small mammals, and other predators of the vicinity. The heavy toucan, despite its long bill, is unable to reach the nest-chamber itself while clinging to the supporting vine or twig, and apparently can not secure a foothold among the thin, loose fibers of the nest, which would seem also to afford poor support to a creeping snake. In a more exposed position, this nest would yield a ready prey to the Swallow-tailed Kite (*Elanoides forficatus*), which hovers on wing while extracting its victims; but these long-winged birds seldom forage beneath the crowns of the forest trees. Of course, not every Royal Flycatcher's nest is inaccessible; but one properly placed and constructed seems to be. How else could so conspicuous a structure escape predation during six or seven weeks of occupancy, in an environment so teeming with nest-robbers that even the tiny hammock of the obscurely colored female manakin rarely eludes detection and spoliation? Of five Colombian Royal Flycatchers' nests with eggs or newly hatched nestlings that I have attempted to follow through, four were successful, while the fifth was lost through an ill-starred experiment of my own. Remembering the high mortality of nests in the forested lowlands, this record must be looked upon either as a most unusual coincidence, or as testimony of a higher degree of safety than most nests enjoy.

The pensile nests of the Short-billed Flat-bill, the two species of *Myiobius*, and the Fulvous-throated Flycatcher, are all shorter than those of the Colombian Royal Flycatcher, and far better enclosed. They swing in a clear space beneath the forest more often than above a stream; they are easy to see but hard to reach; and their occupants develop slowly. Since their success appears to depend upon their being out of reach rather than upon escaping detection, those poorly placed—and there are many—would probably be rifled no matter how short the incubation and nestling periods; but if they attain inaccessibility, the length of these periods is of no great consequence. The beautiful, pyriform, moss-covered nests of the Pipromorpha often dangle from a swinging aërial root beside a trunk or cliff; I have found them in general more accessible than those of the preceding species. They seem to rely more largely upon concealing coloration for safety, and often blend with the mossy trunk or bank beside which they hang. The incubation and nestling periods of these birds are slightly shorter than those of the preceding species.

The pensile nests of the Northern Tody-tyrant (Skutch, 1930) swing from a vine or a slender branch in a plantation, a clearing, or above a watercourse. The similar structures of the Slaty-headed Tody-tyrant usually dangle from the end of a vine beneath a thicket. They seem to be, on the average, more accessible than any of the other pensile nests mentioned here save those of the Costa Rican Piprومorpha; and the incubation period of the eggs they shelter is slightly shorter. The remaining flycatchers, with nests of more 'normal' types, have nearly all shorter incubation periods, although a number lay far larger eggs. Even the hole-nesting Noble and Sulphur-bellied Flycatchers hatch their eggs more quickly than the makers of pensile nests. Size for size, the nestling periods of the birds raised in the cup-shaped and oven-shaped nests, and even in holes in trees, are considerably shorter than of those in the pensile structures.

It seems, then, that among flycatchers, the less accessible the nest, the slower the development of the eggs and young it shelters. It is interesting to speculate upon the long incubation periods of these hang-nest flycatchers. Do we have here a survival of the incubation period of the ancestral flycatchers, which has been progressively shortened through natural selection in the species whose nests are more heavily preyed upon? Or, if the pressure to pass quickly through the highly vulnerable stages of egg and nestling has been somewhat diminished by the development of these peculiar nests, have the periods of incubation and nestlinghood secondarily lengthened?

In fairness, it must be recorded that some of these small flycatchers incubate less assiduously than most of their larger relatives, and than the majority of passerine birds. They appear to find it necessary to devote more time to the search for food. A number that I have watched incubated considerably less than sixty per cent of the day—a very poor record. But a Colombian Royal Flycatcher, during six hours of typical weather, sat for 59.9 per cent of the time and hatched her eggs in 22 days; while a Lawrence's Elaenia, during seven hours, sat in her little cup-shaped nest only 52.8 per cent of the time; yet her eggs hatched in fifteen days.

It is undoubtedly true that if we arrange eggs according to their dimensions, from that of the hummingbird to that of the ostrich—which has a volume more than three thousand times as great!—we find a certain rough correlation between their volume and their incubation periods. Considering the tremendous range in size of birds' eggs, the variation in the length of their incubation periods is surprisingly little; the biggest eggs of existing birds take only six or seven

times as long to hatch as the smallest. The periods of gestation of mammals, and the times required for the development of plant embryos, show a far greater variability.

In a study of the relation between egg volumes and incubation periods, the first great source of error lies in the computation of the volumes from the conventional egg measurements. We may be skeptical of any single formula that pretends to give the cubic capacity of solids so diverse in geometrical figure as, for example, the highly pyriform egg of the Murre and eggs almost symmetric about their short axis, as those of hummingbirds, certain doves, and the Dendrocolaptidae. Another source of error is the varying degree of development of the young bird when it escapes from the shell. To turn to mammals for a comparison, the period of gestation of the horse, a 'precocial' animal, is two months longer than that of 'altricial' man; but can anyone doubt which develops more rapidly? It seems to me that the relationship between egg-volume and incubation period had best be investigated exhaustively for a single family before we attempt to extend it more widely. In a single family, egg-form, body temperature, and the condition of the young at hatching are more uniform than as between diverse families. We have seen that in the flycatchers, whatever tendency there might exist for the incubation period to vary with the size of the egg is quite overweighed by the other factors we have attempted to analyze. Yet in this family we have given incubation periods for eighteen species. The eggs of the largest for which satisfactory data are available, the Noble Flycatcher, have about 3.5 times the volume of those of the smallest, the Lawrence's Serpophaga. This result is obtained simply by comparing the products of the measurement of the long axis by that of the short axis squared. As Amadon (1943) has shown, most of the proposed formulae for egg-volume may be reduced to $V = kLB^2$, where V is the volume, L the length of the egg, B its greatest width, and k a constant. In a comparison between two eggs, the k cancels out.

The records for the other families show the same lack of correlation between size of egg and length of incubation period. Among the thrushes, the big Gray's Thrush hatches its eggs in one to three days less than the smaller nightingale-thrushes. Among the tanagers, the eggs of species of *Ramphocelus* require less incubation than those of smaller members of the family, as the Fanny's and Silver-throated Tanagers. In the Icteridae, there is little difference in the period of incubation of the big Great-tailed Grackle and the far smaller Yellow-tailed Oriole. Among the finches, however, the largest species,

the Costa Rican Atlapetes, has the longest incubation period. In the antbirds, too, the biggest species, the Red-eyed Ant Shrike, has the longest incubation period; but the other species do not follow in the order of their size.

Few families of birds present a greater range in egg-size than the Procellariidae, in which the Fulmar lays eggs of about 8.6 times the volume of those of Leach's Petrel. Worth gives the incubation period of the first as 55 days, of the second as 35 days. But Gross (1935) says of Leach's Petrel: "The longest record that I could obtain of continuous incubation was 42 days, but in all probability incubation endures for at least 50 days."

As usual, when we attempt an investigation of this sort, we find ourselves handicapped by the paucity of authentic, consistent field-data. It is important to remember that contributions such as those of Bergtold, Burns, Worth, the Moreaus, and the present writer, represent the beginning, not the end, of our attempts to understand the incubation periods of birds; and that meanwhile we must preserve an open mind and collect far more records from all parts of the world. When we recall that from tropical Africa and America together, probably less than two hundred incubation periods have been determined, and that many of these determinations rest upon a single nest, we begin to become aware of the immensity of the task that lies before us. That it is not an easy task, no one is more keenly conscious than myself. When we know the incubation periods of two or three thousand species, each one based not upon a single nest but a good number of them, we may theorize with some degree of confidence in our primary data.

When we turn to nestling periods, we find them on the whole less constant for the species than incubation periods; but this seems to be largely because the young birds are often frightened from the nest somewhat prematurely. Yet where external factors, such as the approach of a potential enemy, shaking of the nest, or the like, do not intrude, I believe that the departure of the young bird from the nest is as spontaneous a process as its earlier escape from the shell. While some writers have described various stratagems of parent birds to bring their youngsters into the open, I have witnessed the departure of nestlings of a number of species without seeing any evidence of successful parental pressure to effect this result. Only exceptionally have the old birds seemed to display any eagerness to have their offspring quit the nest—provided, of course, that they did not appear to be in danger. A pair of Fraser's Tityras, after the departure of

their first nestling from the old woodpecker hole high in a dead trunk, seemed very eager to have the other two follow. But their efforts to call forth the laggards were quite without effect until the young birds were ripe for departure. The three fledglings flew from their lofty nursery on successive mornings at very nearly the same hour—7:44, 7:08, and 7:48 A. M.—doubtless in the order of their birth.

As Mrs. Nice (1937) found to be true of the Song Sparrow, a small brood does not necessarily leave the nest any sooner than a large one. Yet Moreau (1940) has shown that, with some species at least, a lone nestling may receive considerably more food than a member of a larger family. Since birdlings as they grow older are often so closely packed in the nest that it would seem that the very pressure of their bodies must force some of them into the open, may it not be that the greater amount of room enjoyed by a lone nestling offsets the more rapid development that may possibly result from more abundant feedings? Three broods of the same pair of Panamá House Wrens, which I was careful not to disturb, left the same gourd at the same age—eighteen days—although two consisted of three fledglings, and the third of only one. In my own experience, nestling periods, when determined with due care not to frighten the young birds, show hardly more variability than the incubation periods of the same species. This is clearly shown in the records for Lawrence's Elaenia, Gray-capped Flycatcher, Colombian Royal Flycatcher, Gray-headed Nightingale-Thrush, Gray's Thrush, Orange-bellied Myioborus, Mexican Bananaquit, and Cherrie's Tanager.

It is instructive to compare, as the Moreaus (1940), following Stresemann, have done, the incubation and nestling periods of the same species. On the whole, my results are in accord with theirs. In general, as they point out, the nestling periods of small altricial birds—except hole-nesters and long-winged species like swallows and swifts—are of about the same length as their incubation periods. It is interesting to observe this rule at work among the small flycatchers with pensile nests. Their nestling periods are as unexpectedly long as their incubation periods, and doubtless from the same cause—relative freedom from predation.

Few land birds remain in the nest two or more times as long as they require to hatch. Of those reported upon in this paper, only the Blue-throated Toucanet and the Trujillo Woodpecker have nestling periods so much in excess of their incubation periods. Doubtless the other woodpeckers would fall into this class, were their incubation periods known; and as recorded elsewhere (Skutch, in press),

I have reason to believe that the Prong-billed Barbet takes at least four weeks—more than twice as long as its incubation period—to fledge. The Moreaus report the incubation period of an African barbet, *Tricholaema leucomelan,* as fourteen to fifteen days, and its fledging period five weeks. It will be noted that all of these birds nest in deep holes in trees. The young become feathered slowly, then linger in the nest for a long while after they are completely clothed. Why should their incubation period be so accelerated, their nestling period so protracted? Are the eggs subject to serious perils from which the nestlings are relative immune? If so, my studies of these birds have failed to disclose what these dangers are. Among the trogons, the Mexican Trogon, which nests in a shallow niche in a decaying trunk, has a nestling period shorter than the incubation period; while for the Quetzal, which carves a deep hole, the nestling period is less than twice as long as the incubation period.

Birds which nest in burrows in banks, as kingfishers, motmots, jacamars, and some of the swallows and ovenbirds, are, in my experience, of all birds safest from predatory animals. Their nestling periods are long; but their incubation periods are also long. There is not the contrast between the two periods that we meet among woodpeckers, toucans, and barbets.

Nestling periods markedly shorter than the incubation periods are found in the antbirds. For these denizens of the undergrowth of the tropical forest with its thousand perils, swift hatching would seem to be of great value. Yet, notwithstanding that in most species the eggs are kept almost constantly covered by both parents, the embryos develop slowly, as with all Clamatores (Tyranni). Here again, as with the related flycatchers, we find the trait of a taxonomic group persisting in the face of ecological pressure which, theoretically, should cause a change. The young antbirds hatch blind and quite naked, but develop with surprising rapidity. At the age of eight days they are feathered, and on the ninth or tenth day, before they can fly, young Slaty Ant Shrikes, Bridge's Ant Shrikes, and Northern Bush Birds hop from the nest and disperse through the undergrowth. The Long-billed Antwren, another denizen of the forest undergrowth, which in classification has been bandied about between the Formicariidae and the Sylviidae, likewise has a far shorter nestling than incubation period; the youngsters leave their mossy nest before they can fly.

In the present paper, I have not attempted to compare the incubation and nestling periods of tropical American birds with those of

their nearest relatives in the temperate portions of the continent. In some instances, the periods appear to be substantially the same; but in others there is evidence of accelerated development of embryos and nestlings at the higher latitudes. This question is now being investigated.

SUMMARY

Difficulties inherent in the determination of the true incubation and nestling periods of birds are discussed. If the nest is inspected only once each day, the visit should be made in the afternoon, since the critical events—laying, hatching, and departure of the young—occur predominantly in the morning. To learn the true nestling period—the age of spontaneous departure—precautions must be taken not to frighten the nestlings; and they should not be removed from the nest for weighing or measurement after they are feathered.

Incubation periods are given for about 90 species of Central American birds, and nestling periods for about 120 species. The great bulk of these data is here published for the first time. Egg-measurements are given for most of the species treated.

The length of the incubation periods appears to be determined by the taxonomic position of the species, the size of the egg, ecological factors such as the dangers to which the nest is exposed, and doubtless other influences as well. The flycatchers which build pendent nests have amazingly long incubation periods, which appear to be correlated with the relative inaccessibility of their eggs. The long incubation periods of flycatchers, as compared with other birds that build nests of the same types in the same habitats and lay eggs of the same size, are cited as an example of the influence of taxonomic position on the rate of embryological development. The birds considered here present only a small range of egg-sizes (about 3.5 to 1 in the Tyrannidae); and whatever influence the volume of the egg may have on the length of the incubation period is completely overshadowed by other factors. Since the amount of actual incubation which eggs receive during the period of diurnal activity varies from 50 to 100 per cent in diverse species, this must not be lost sight of in attempting to analyze the lengths of incubation periods. Above all, it is emphasized that we need far more carefully determined incubation periods from all parts of the world, before we can draw more than tentative conclusions.

If the nestlings are not frightened, their departure from the nest is, with most species studied, as spontaneous as their earlier escape from the shell. The great variability in the recorded nestling periods of a single species is caused in large part by careless practices of the

observer. When the young birds are not disturbed, the nestling period of a species is almost as constant as its incubation period.

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OBSERVATIONS OF THE LOON IN THE CARIBOO PARKLANDS, BRITISH COLUMBIA

BY J. A. MUNRO

Plates 4, 5

THE Cariboo Parklands is a section of the interior plateau of British Columbia noted for the number and variety of its watered areas that together comprise the most productive waterfowl nesting grounds in the province. The present paper, a contribution to the life history of the Loon, *Gavia immer* (Brünnich), is based on observations made in this region during the summers of 1936 to 1943, inclusive, but includes other pertinent data acquired elsewhere, chiefly during earlier years.

Loons arrive in the Cariboo Parklands shortly after the ice has gone from the larger lakes, which usually takes place in late April. Farther south on Okanagan Lake, at this time, it is common to see loons in flocks sometimes containing as many as 40 individuals, and such flocks have been recorded as early as April 10 and as late as May 3. Whether these represent pre-nuptial associations or gatherings of sexually immature, non-breeding birds has not been determined. No such flocks have been observed on the Cariboo lakes. The loons that arrive there first would seem to be sexually mature, since very soon after arrival they become established on the territories they will occupy during the summer.

The population seems to be nearly stationary. The same small lakes are occupied each year by single pairs while other lakes, that to all appearances afford the same facilities of nesting sites and food, are avoided. Each year, also, the larger lakes, all of which support loon populations, have approximately the same number of occupied territories.

The use of certain small lakes as breeding grounds and the avoidance of others cannot be correlated with the presence or absence of fishes as is commonly believed. Reference to the table on page 39 will make this clear.

In this table, "trout" means Kamloops trout, *Salmo gairdneri kamloops*, or other Salmonidae; "other fishes" means the so-called coarse fishes and includes no species of Salmonidae nor any commercially valuable species.

It will be seen that twelve loon populations totalling 53 adults occupied lakes in which trout, or trout together with other fishes, was an element in the food potential; that ten populations totalling 26 adults occupied lakes in which species other than trout represented

Locality		Date	No. of adult loons	Food Items: Trout	Other fishes	Amphipods	Mollusks	Aquatic insects
Deka Lake (part)	9 × ¾ m.	July 28, 1936	5	x	x	x	x	x
Disputed Lake	50 acres	July 29, 1936	2			x	x	x
Dempsey Lake	1 × ½ m.	Aug. 10, 1936	2	x	x	x	x	x
Longbow Lake	1¼ × ¼ m.	Aug. 17, 1936	2			x	x	x
Fawn Lake	1¼ × ¼ m.	Aug. 17, 1936	4	x	x	x	x	x
Slough, Clinton	4 acres	July 13, 1937	1			x	x	x
Horse Lake	7 × 1¼ m.	July 22, 1937	17	x	x	x	x	x
Williams Lake (part)	5 × ½ m.	Aug. 2, 1937	3	x	x	x	x	x
Lily Pad Lake	1½ × ¼ m.	Aug. 7, 1937	2		x		x	x
Langley Lake	½ × ⅛ m.	May 1, 1938	2	x				x
Exeter Lake	1 × ⅜ m.	July 7, 1938	1		x	x	x	x
Succour Lake	⅝ × ¼ m.	July 13, 1938	2		x		x	x
Straight Lake	2 × ⅛ m.	July 15, 1938	2				x	x
Simon Lake	1¾ × ½ m.	July 15, 1938	4			x	x	x
Roundup Lake	50 acres	July 15, 1938	2				x	x
Pete Kitchen Lake	80 acres	July 18, 1938	1				x	x
Slough	4 acres	July 20, 1938	1			x	x	x
Abel Lake	80 acres	July 22, 1938	2		x	x	x	x
Rail Lake	2 × 1 m.	July 25, 1938	7	x	x	x	x	x
White Horse Lake	1¼ × ¼ m.	July 27, 1938	4		x	x	x	x
Shermer's Lake	10 acres	July 27, 1938	2				x	x
Tad Lake	¾ × ⅛ m.	Aug. 1, 1938	2	x	x		x	x
Beaver Dam Lake	30 acres	Aug. 20, 1938	2	x	x		x	x
Tatton Lake	1½ × ⅛ m.	June 11, 1940	4			x	x	x
Boitano Lake	1¼ × ⅜ m.	June 12, 1941	2			x		x
Alkali Lake	¾ × ⅜ m.	July 9, 1941	2		x		x	x
Indian Dam Lake	80 acres	July 11, 1941	2			x	x	x
130 Mile Lake	1¼ × ¼ m.	June 4, 1942	2	x	x	x	x	x
Jones Lake	75 acres	June 29, 1942	2		x	x	x	x
103 Mile Lake	¾ × ¼ m.	July 2, 1942	3			x	x	x
Anthony Lake	30 acres	July 5, 1942	1	x	x		x	x
105 Mile Lake	1¼ × ½ m.	July 13, 1942	2			x	x	x
Lac La Hache (part)	10½ × 1½ m.	July 10, 1943	6	x	x	x	x	x
108 Mile Lake	1¼ × ¾ m.	July 24, 1943	7		x			x
Sheridan Lake (part)	5 × 2 m.	July 28, 1943	2		x			x

the fish food element and thirteen populations totalling 28 adults occupied lakes from which fishes were absent.

Most of the lakes containing fishes are large and their total area is much greater than the total area of lakes without a fish population. Thus the fact that the largest population of loons inhabits the former is less significant than it would be if the totals of areas were of comparable size.

NESTING

The majority of nesting sites fall into three categories—namely, muskrat houses, shore sites and floating sites. The muskrat houses occupied by nesting loons are usually those situated some little dis-

tance from shore where the water is at least a foot in depth. It is commonly the case that marsh growth affords protective cover on three sides while the fourth side is open with direct access to fairly deep water. Often the muskrat runways fulfill this necessity. Shore sites may be on an open beach or a marsh-edged shore; in the latter the nest always is beside an escape-channel. Floating sites are at the edge of a cattail marsh or in a stand of round-stem bulrush. In the latter the nests may contain a very large amount of material, of which the greater part is submerged and resting upon the solid root system of the bulrush. One essential for all sites is direct access to open water so that a sitting bird after being alarmed my slide off the nest and escape under water.

When muskrat houses are occupied as nesting sites, the eggs are laid in a scraped-out depression, no nest material other than that provided by the house itself is used. Actually, in some instances, it is impossible to determine whether a site is an old muskrat house or a chance accumulation of marsh debris. Nests built on the two other types of site—*i. e.*, those referred to as shore sites and floating sites—vary only slightly in character and the material used is almost invariably bulrush and cattail. The descriptions that follow illustrate the degree of variation in nest site and nest construction.

Muskrat house sites

Horse Lake, May 30, 1937. Site an old muskrat house 100 feet from shore in *Equisetum* marsh (Plate 4, fig. 2).

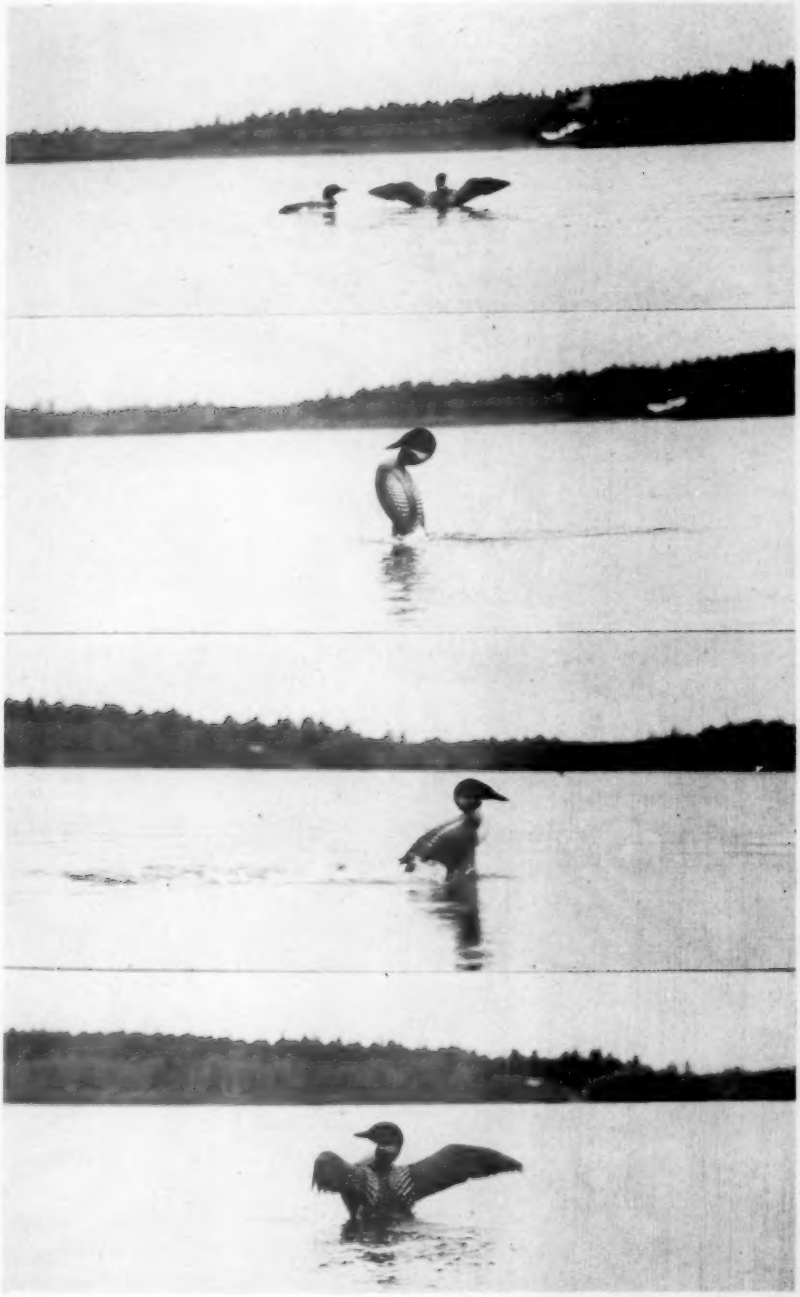
130 Mile Lake, June 4, 1942. Site at outer edge of round-stem bulrush and cattail marsh fronting on water covered by pads of yellow pond lily, *Nuphar polysepala*. The muskrat house, made of rotted bulrush, rested upon a submerged bulrush root system with its exposed portion, approximately four feet in greatest diameter, ten inches above water at the highest point. A depression about twelve inches wide held the eggs (Plate 4, fig. 3).

Shore sites

Williams Lake, June 2, 1942. Site under overhanging branches of dogwood between the base of a two-foot bank and the water's edge on a narrow, stony beach of a wooded island. The nest, two feet by three feet, was made of round-stem bulrush, all of which, except the upper surface, was sodden, apparently from wave action.

Lac La Hache, June 28, 1942. The site was on the outer edge of a narrow strip of shore-line marsh about five feet out from the hard shore of a marshy bay. The nest, measuring two feet across its widest

NESTS OF LOON.—FIGS. 1, 5, 6—FLOATING TYPE; FIGS. 2, 3—ON MUSKRAT HOUSE; FIG. 4—SHORE TYPE.



BEHAVIOR OF THE LOON NEAR THE NEST.

diameter, was made of bulrush built up from the lake bottom in water five inches deep. In front, a small clump of bulrush, probably grown tall since the nest was constructed, afforded some cover; to one side a well-marked trail through submerged vegetation led from the nest to open water; this was the entrance. On the opposite side of the nest, in front of and below what was identified as the usual place of exit, a space about six feet in circumference in the sandy lake bottom measured about eight inches lower than its surroundings. This extra depth undoubtedly facilitated the loon's departure from the nest. The excavation seemed of recent origin and possibly had been scraped out entirely, or at least deepened, by the continuing impact of the bird's body on the sand as it left the nest through the course of several weeks.

Floating sites

Lac La Hache at 121 Mile, May 31, 1942. At outer edge of open bulrush stand, *Scirpus acutus,* near entrance to marshy bay. The nest, two feet by three feet, was made of bulrush; the foundation rested on an invisible bulrush root-system in water three feet deep; the portion above water was entirely dry (Plate 4, fig. 2).

Tatton Lake, June 3, 1942. The site at edge of channel between two sections of a round-stem bulrush marsh. The nest, 18 inches in diameter, was made of bulrush resting on a submerged root-system with rim four inches above water; bulrush, *Scirpus acutus,* both old and new growth, provided cover on three sides (Plate 4, fig. 3).

Jones Lake, June 29, 1942. Site on the outer edge of a cattail marsh. The nest, a floating mass of cattail stems, was screened at the back by tall cattails and at the front by a small clump of bulrush. An escape-channel three feet long led through the cattails at the back to deep, open water.

There is much variation in color, shape, and size of eggs—and this is a fruitful field for enquiry. It would be of interest to know if such characters are fluid or static and whether or not a particular egg type is constant with a particular individual. One clutch examined in which one egg was darker and about one-third smaller than the other can be considered abnormal (Plate 4, fig. 4).

In regions south of the Cariboo Parklands, nests of quite different character have been examined. Thus at Lac Le Jeune, near Kamloops, June 5, 1922, a deeply concave nest on a small grassy island situated in a narrow channel that drained a beaver meadow, was 18 inches in diameter, and in its construction, sedge stems, leaves, and roots, and a little moss had been used—material that was available close at hand. Another at Echo Lake, near Lumby, May 13,

1940, consisted merely of a shallow depression on top of a mossy log, partly submerged and jutting out from the shore. The depression that was unlined had been made by removing the moss; the single egg rested on partly decayed wood.

From these observations, that have identified various types of nest sites and nest material, it may be adduced that the loon is most adaptable in nesting habits, using whatever site and material is available.

TERRITORY AND TERRITORIAL BEHAVIOR

An entire small lake will constitute a territory for one mated pair while larger lakes may contain two or more. Thus Tatton Lake, one and one-half miles long, supports two nesting pairs, whose territories are separated by intervening marsh growth. The population of Lac La Hache, 12 miles long, usually is three pairs, one near the west end of the lake, two others about five miles to the east. The territories of the latter center about two adjacent marshy bays separated one from the other by a long, narrow peninsula. On all large lakes, loons show a decided preference for marshy bays; these and their adjacent waters are occupied year after year. The yearly period of occupation by a pair, whether successful or not in raising young, lasts from early May until mid-August. During all this time the loons feed within a circumscribed area and show little tendency to extend the field of operation. Territories are often invaded by single birds, by couples or small bands engaged in the search for food; these are considered to be non-breeding individuals. Pairs with eggs or young and even pairs unsuccessful in nesting are definitely sedentary as has been suggested. Invasion of their territories by other loons may be resented or it may not; probably unsuccessful pairs are more tolerant of intrusion. Thus at Horse Lake in July, 1936, one of a pair without young took note of an intruder as it approached from a distance by repeating a short, single note at regular intervals but made no hostile demonstration. (Munro, Condor, 39: 163–173, 1937.)

At Tatton Lake, June 3, 1942, a pair on open water, about 200 yards distant from their nest in the shore marsh, was approached by a second male, and immediately the first male 'ran' over the water toward it. In this manner of travel it appeared as if the body were held above the water by slow wing-strokes that struck the surface with regular beats, causing a turmoil of spray that was added to by the 'running' feet. When about 200 yards from the intruding male he dived and upon emerging swam back to the female while the intruding male retreated. The first male called only once, the intruding male was silent.

The following behavior, observed on June 24, 1922, at Swan Lake, did not appear to represent defense of territory but rather a recrudescence of courtship display. The males of two pairs, swimming close together, simultaneously left the females and dashed away at a great rate of speed, in opposite directions, propelled by powerful wingbeats. The body was about two-thirds out of water, head and neck straight out six inches or so above the surface. Both called continuously with the laughing cry. In this swimming flight the birds followed the arc of a circle that brought them back to the females. At its conclusion, both stood upright with chest out and head back, then gave the laughing call several times in quick succession.

Loons become greatly excited by the appearance of a boat on their territories, an excitement that finds vent in behavior which varies somewhat with the individual and reaches the highest manifestation when the young are on the water.

It is the male that shows the greatest excitement and performs most of the somewhat grotesque actions that are a source of such interest to the beholder (See Plate 5). The performance may be given by a cruising male while its mate is incubating or by one that, accompanying female and young, remains close to the observer while the latter swim away. One common action is to surge over the surface half out of the water, then dive to reappear within a few yards and surge again. Another is to stand nearly upright with neck curved back, chest outthrust, the wings half-opened and curved forward. Sometimes one will approach a boat in a series of springs that takes the body clear of the water, which causes such disturbance on the surface that the mechanics of the movement are impossible to detect. These performances may be accompanied by one or another of the varied calls in the repertoire that is at the loon's command. More often than not they show little fear and may approach a boat within a few yards.

The reactions of nesting pairs and of pairs with young as observed under these circumstances are detailed in the following section.

Behavior of nesting pairs

At Lac La Hache, May 31, 1942, when a nest with two eggs was examined, the pair, at a distance of 50 yards and less from the site, swam back and forth and occasionally dived. Both birds were silent until the canoe was paddled from the vicinity, when one gave a single call. It is of interest to note here that this pair, accompanied by one young, was still on the territory on June 28, as was a second pair on an adjoining territory. The nest and eggs of this second pair also had been examined on May 31 and it, too, was accompanied by one young on June 28.

A female on a nest at 130 Mile Lake, June 4, 1943, allowed an approach within 50 yards. It had assumed a peculiar position with neck draped over the nest-rim and bill pointing down toward, and almost touching, the water. When approached closer she slid off, dived, and was not seen again amongst the expanse of lily pads that covered the water for 100 yards or more in front of the nest. Later the pair was heard calling half a mile away and later still, when a heavy rain squall came down the lake, the two birds flew past high in the air and called repeatedly.

Other nesting pairs under observation remained in the vicinity of the nest and were silent; on rare occasions only one of the pair was present.

Behavior of pairs with young

At Horse Lake on July 16, 1937, a female and her mate, accompanied by one young about a month old, were swimming close together not far from the nest site. It was observed that she accommodated her swimming speed to the slower progress of the young bird so that it was possible in a canoe to draw quickly toward them. Meanwhile, the male swam away in a different direction, sometimes surging over the surface with body half out of the water, chest outthrust, and head and neck retracted while he called repeatedly. When the canoe was about 30 yards from the female, she made a series of quick dives and sudden emergences, barely breaking the surface as she rose, so that the commotion on the water resembled that made by a rising trout. During this time the young bird swam off in a fairly straight course. The lake was perfectly calm so that the bird's progress could be detected by the regular appearance of the crown of its head or by a slight ripple on the glassy surface of the water. Gradually, as the bird tired, the time of submergence lessened until it was possible to paddle directly over its course. Then it could be seen, as it swam below the surface beside the canoe, that the rudimentary wings were held close to the sides and that motion was attained solely by vigorous thrusts of the feet. Finally the bird was captured and photographed. Upon being released, it immediately dived and swam under water for 20 yards or so before emerging. After a succession of such dives that carried it 100 yards or more, it was joined by both parents. A month later it was seen again on the territory accompanied by both parents. It was then about half-grown.

On the same territory, July 18, 1943, the male of a pair approached a moving canoe within 30 yards and accompanied it at this distance for five minutes, giving the laughing-call repeatedly. At the same time the female and one small young were swimming along the opposite

shore of the lake a quarter of a mile distant, and she answered the male's laughing-call with a long drawn-out, quavering *whooo,* or a short three-note sequence, *whoo ah wah.*

On June 27, 1941, at 130 Mile Lake, a pair was accompanied by two young about a week old, and both parents stayed with them and remained silent when the family was approached by canoe.

On Tatton Lake, July 2, 1941, the single large young remained with the female while the male, 50 to 100 yards away, made the characteristic demonstrations and called repeatedly.

At Jones Lake, June 29, 1942, a male swam 200 yards or so ahead of a female that was accompanied by two small young.

At Horse Lake, July 16, 1943, the male of a pair whose territory included a marshy bay was swimming across its wide entrance while the female with one quarter-grown young remained at the upper end of the bay, 500 yards distant. The former approached the observer's canoe until it was 60 feet or less from it, then turned and swam in a different direction, keeping about the same distance ahead. This continued for about ten minutes during which time the loon six times repeated the following performance, *viz.,* it rose in the water until it had assumed an almost vertical position with body turned slightly sideways (so that the white underparts were in full view) and, with head and neck retracted, it churned the water with its feet for several seconds, giving the laughing-call at the same time. In the intervals between these displays it swam slowly ahead on the surface, calling almost continuously. The female, out of sight near the head of the bay, answered with the laughing-call.

Pairs that have deserted or lost their eggs react in a similar manner to human presence even long after the desertion or loss has taken place. Thus at Horse Lake a pair was noted daily from May 26 to June 1, 1937, and again on July 14, on a territory comprising a marshy bay and adjacent waters that had been occupied each of the four years the lake was under observation. On July 14, the male was as demonstrative as it had been in May although the nest had been deserted for so long that the eggs were half-buried in the nest debris with their upper surface faded and the contents decomposed.

The behavior of these loons, unsuccessful in nesting, is possibly a mechanical reaction indicative of a particular physiological stage in the reproductive process and produced automatically when the nesting territory is invaded by enemies (Munro, Condor, 39: 165, 1937). On several lakes where nesting had not been successful, territory-defense has been observed as late as the first week of August.

On lakes where nesting has been uniformly unsuccessful, the entire population may at times associate in a flock and individuals may perform certain of the territory-defense actions. Thus, on Lac La Hache in 1937, none of the four pairs raised young and on several occasions in late summer the eight birds were seen together. On one such occasion a member of the flock swam in a straight line about 200 yards from shore for a distance of about half a mile, and at regular intervals struck the water sharply with partly-spread wings, sometimes a dozen or more times in quick succession, producing by this rapid movement a series of sharp reports that could be heard a quarter of a mile distant.

Survival of young

A large proportion of the nesting is successful in that the eggs hatch. In six instances where the history of a nest was followed through, both eggs hatched; in two others, one egg hatched and each of the others contained a small dead embryo; two other nests with eggs were deserted but both pairs remained on their territories for at least a month afterward. There is, however, a very considerable failure at some point in reproduction because invariably in late summer the greater part of the population consists of mated pairs without young; generally it is not possible to determine whether this is due to the loss of eggs or the loss of young. Furthermore, the number of pairs accompanied by one young is greater than the number of pairs accompanied by two young.

It seems, also, that some pairs remaining together for most of the summer do not lay eggs although they may construct rudimentary nests. Thus a pair on 105 Mile Lake, June 4, 1937, showed concern whenever I approached a small island near the center of the lake, and when I landed on it they swam back and forth close to what appeared to be their nest-site. This was the top of a newly-built muskrat house situated at the end of a stony point and constructed largely of sago pondweed, *Potamogeton pectinatus*. Later, as I paddled around the circumference of this small lake, the loons followed, swimming both on and below the surface. No loons were present when the lake was next visited on August 6 and again on August 16. It was observed on May 27, 1941, that a pair had established a territory at exactly the same place, and a muskrat's feeding place of dry rushes on the shore of the island showed indications of having been used by them. The pair was still on this territory on June 27 and was seen there later in the summer, but no eggs were laid so far as could be learned.

Some, at least, of these abortive pairings do not persist through the summer, and it frequently has been observed that a small lake may be occupied in June by a pair and by only one bird in July. Invariably a search for a nest in these circumstances was not successful and it was considered that none had been built. The breeding status of these birds is uncertain.

The yearly totals of adults and young with the number and size of broods as enumerated on various lakes in the Cariboo region, where the fact of nesting was established, are set forth in the tabulation below. It is not known what proportion of the adults represents non-breeding birds. What were actually identified as such have not been included in the tabulation. The variation in numbers is not an indication of changing numerical status.

LOON POPULATIONS IN CARIBOO REGION DURING JULY AND AUGUST

1936—40 adults and 9 young—2 pairs, each with 2 young; 3 pairs, each with 1 young.

1937—52 adults and 3 young—1 pair with 2 young; 1 pair with 1 young.

1938—40 adults and 6 young—1 pair with 2 young; 4 pairs, each with 1 young.

1939— 6 adults, no young

1941—12 adults and 3 young—1 pair with 2 young; 1 pair with 1 young.

There remain for consideration what definitely seem to be non-breeding populations. These consist of single birds or couples established on small lakes that often are occupied in successive years. This fact has been established many times at different places. Usually solitary birds are silent and difficult of approach. In the non-breeding category also are some members of the population frequenting larger lakes. They are not restricted to any particular territory but range over the entire lake, very often in small flocks as at Horse Lake which is seven miles long. A lake at 108 Mile ($1\frac{1}{4} \times \frac{3}{4}$ m.) is a resort of six to eight birds that, in five out of the six years the lake was visited, were identified as non-breeding. It has been observed that none exhibit the fearlessness or indulge in the varied display that mated birds do on their territories.

FOOD

On some waters, fishes would seem to form a considerable part of the loons' diet. Thus 108 Mile Lake, which yearly supports a non-

breeding loon population usually numbering eight birds, as has been mentioned, contains lake shiners, *Richardsonius balteatus,* and suckers, *Catostomus* sp., but no amphipods nor mollusks and relatively few aquatic insect larvae. It can be assumed that the fishes mentioned form the chief food supply for the loons.

It seems remarkable how seldom visible evidence of the loons' fish diet is obtained. Mr. Sigurd Larum, a reliable observer who lives at Horse Lake, related the following incident. In July, 1943, two loons were seen swimming along the shore of Horse Lake, one with a fish about 14 inches long, either a sucker or a squawfish, *Ptychocheilus oregonensis,* that apparently was too large to be swallowed. The loon swam parallel with the shore, pulling the fish along the surface; several times the fish escaped but was seized quickly again. The second loon following behind did not take part in what seemed to be a struggle pursued with great effort and continued at least for half an hour or so until both birds passed out of sight behind a point on the shore.

Another quite dissimilar incident, but indicating a fish diet, has to do with a loon on Paul Lake, near Kamloops, May, 1936, that struck at an angler's trolling spoon and carried it away attached to a portion of the trolling line. A day or so later it was found along a tributary stream with the line entangled in a bush so that escape was made impossible. The person finding it broke the hook and released the bird. About two weeks later it was found dead with the barb of the hook still imbedded in the throat muscles.

That fishes are not essential, however, has been noted earlier; many lakes without fish life are used by both nesting and non-breeding loons. That a diet other than fishes is not unusual is testified to by the few stomachs that have been examined. All but one of these were taken in the interior of British Columbia but outside of the region covered by this paper. Nevertheless, as conditions at the places of capture approximate those of the Cariboo Parklands, this material is considered pertinent.

STOMACH CONTENTS OF FIVE LOONS

Adult ♀. Mara Lake, May 18, 1922. Shell fragments of mollusca, including *Planorbis* sp., 100%.

Adult ♀. Lac La Jeune, June 5, 1922. Small quantity of caddis debris, 100%.

Adult ♀. Lac La Jeune, June 6, 1922. Small quantity of amphipod debris, 100%.

Adult ♀. McGlashan Lake, April 23, 1940. Fragments of at least 150 amphipods many, if not all, *Gammarus limnaeus,* 70%;

10 whole corixids *Arctocorixa sutilus* Uhl, and fragments of at least 50 other corixids, 30%.

Downy young. 130 Mile Lake, June 26, 1941, bones of small unidentified fishes, probably *Richardsonius balteatus*, 75%; fragments of dragonfly nymphs, 5%; vegetable debris, 20%.

All the adult stomachs contained gravel; in one specimen were 14 pieces up to 18 mm. in length.

Okanagan Landing
British Columbia

DISTRIBUTION AND TAXONOMY OF THE BLACK-CAPPED CHICKADEES OF NORTH AMERICA

BY ALLEN J. DUVALL

DURING the course of identifying specimens that have recently come to the Biological Survey collection, I have been impressed, as have some previous investigators, by the similarity of Black-capped Chickadees from eastern Washington to those of the eastern United States. Apparently much has been written on this supposed 'colony' or 'island' of eastern-type Black-capped Chickadees, which, according to Ridgway (1904: 398), are inseparable from *atricapillus*. After intensive study of a large number of specimens, taken at all seasons of the year, the writer feels that, although these birds appear much like the eastern population, they are readily separable when compared with specimens in comparable plumage. Further discussion of these birds will be taken up later.

In the course of this study, over 800 specimens were available, including the type series and the types of both *practicus* and *turneri*, as well as three cotypes of *occidentalis;* the other three specimens of *occidentalis* listed by Baird (U. S. National Museum Nos. 6768, 4538, and 9219) were sent to other individuals or museums. In addition, the writer also had available the type series (excluding the types) of *nevadensis, anamesus, aldrichi,* and most of *bartletti;* also the type of *albescens* was examined.

The writer wishes to express his appreciation and thanks to the following institutions and individuals for the loan of material which made this study possible: Museum of Vertebrate Zoology, University of California (Dr. Alden H. Miller); University of California (Donald R. Dickey collection), Los Angeles (A. J. van Rossem); Carnegie Museum (W. E. C. Todd); and the Cleveland Museum of Natural History (Dr. Harry C. Oberholser); also Dr. Ira N. Gabrielson, Allan

Brooks, Dr. Paul Bartsch, Stanley G. Jewett, and Dr. Harry C. Oberholser, for the loan of specimens from their private collections. Thanks are also given to Dr. Herbert Friedmann, Dr. John W. Aldrich, and Dr. Harry C. Oberholser, for helpful comments during this study. The writer also wishes to thank W. E. C. Todd and Arthur C. Twomey for comparing specimens from west-central Canada with the type series of *anamesus* in the Carnegie Museum.

Linnaeus (1766) described the chickadee, *Parus atricapillus,* based on *Parus canadensis atricapillus* of Brisson (1760), who merely gave Canada as the locality whence the species came. Almost a century later (1843), Edmond Selys-Longchamps described *Parus frigoris* from a specimen reported to have been taken in Iceland, where the species is not known to occur. Harris (1845) named the Long-tailed Chickadee *Parus septentrionalis,* from about 30 miles above the junction of the Yellowstone and Missouri rivers. Brehm (1855) named *Parus melanocephalus* from North America. Spencer F. Baird (1858), by inference, described and named a bird from New Mexico as *Parus albescens,* while in the same work a dark form from the Pacific coast was published as *Parus occidentalis.* Robert Ridgway (1884) named the bird from the extreme northwestern part of its range (coast of Alaska) *Parus atricapillus turneri,* and Dawson and Bowles (1909) suggested the name *fortuitus* for the bird from southeastern Washington, northern Idaho, and central southern British Columbia. Oberholser (1937), on the basis of fine series of birds collected by Thomas D. Burleigh, described the Black-capped Chickadee from the southern Appalachian Mountains as *Penthestes atricapillus practicus,* and Todd (1938) proposed, as new, the bird from the southern James Bay region, calling it *anamesus.* In 1938, also, Linsdale separated the bird from the arid region of northeastern Nevada as *nevadensis.* Aldrich and Nutt (1939) separated the Newfoundland bird from typical *atricapillus* and called it *bartletti.* Finally, Braund and McCullagh (1940) separated the bird from Anticosti Island as *aldrichi.*

The American Ornithologists' Union Committee on Nomenclature, in the Check-List of North American Birds (1886 and 1895), used the generic name *Parus* Linnaeus (1758: 189) for the chickadees of North America; while in the 1910 and 1931 editions of the Check-List, *Penthestes* Reichenbach (1850: pl. 62) was employed. Selys-Longchamps (1884: 51) revived the genus *Poecile* Kaup (1829: 114) for the true chickadees. There have been several other genera proposed for Old World species (Hellmayr, 1911: 45) which have no direct bearing on this discussion. More recently, however, Hellmayr

(1934: 70) grouped all the true chickadees under the genus *Parus*. He stated: "Unless a large number of more or less artificial generic groups, having no other than nominal value, be accepted, the only logical course is to unite all the true chickadees in the genus *Parus*, a procedure that seems to us the lesser evil."

In order to determine what genus to use for the North American Black-capped Chickadees, an examination of specimens of the type species of *Parus* Linnaeus (*Parus major*), *Penthestes* Reichenbach (*Parus lugubris*), and *Poecile* Kaup (*Parus palustris*), was made. This study revealed that all three of the above-named genera are inseparable from one another; none of the characters as given by previous authors are constant or considered as good generic differences. Thus, as *Parus* Linnaeus is the earliest available generic name, it should be used as Hellmayr (*loc. cit.*) has stated. [The current A. O. U. Committee in the Nineteenth Supplement to the Check-List (Auk, 61: 453–454, July, 1944) has adopted this arrangement.—ED.]

The Old World chickadees (marsh tits, etc.) formerly were considered specifically distinct from the New World chickadees (*atricapillus*). Hartert (1905: 376, footnote) considered the Old World birds conspecific with both the Black-capped and Carolina Chickadees of North America, which procedure has been followed in part by other authors. After comparing a good series of birds from Scandinavia, France, Japan, and Siberia with those from Alaska and the United States, I find that the Old World birds are specifically different from the New World chickadees in having the black throat patch extending only to the ramus, whereas in the North American or New World chickadees the black extends well beyond the ramus; also, in Old World birds, the black of the throat is much overlaid with white tips to the feathers, while in New World examples the white tips are usually restricted to that area where the white and black of the ventral surface meet. The character of the restriction of black to the ramus parallels that of the restriction of yellow in the Western Meadowlark (*Sturnella neglecta*). Inasmuch as *atricapillus* was based on the North American Black-capped Chickadee, no change in name is necessary for the American black-caps.

For a discussion of the specific distinctness of *carolinensis* versus *atricapillus*, the reader is referred to Brewster (1886: 177), Oberholser (1918: 465), Hellmayr (1934: 72, footnote 1), and Jouard (1936: 450).

Following is a discussion of the various races of *Parus atricapillus*.

Parus atricapillus atricapillus (Linnaeus), EASTERN BLACK-CAPPED CHICKADEE

Parus canadensis atricapillus Brisson, Ornith., 3: 553, pl. 29, fig. 1, 1760.

Parus atricapillus Linnaeus, Syst. Nat., ed. 12, 1: 341, 1766.

Parus melanocephalus Brehm, Vogelfang: 242, 1855.

Penthestes atricapillus aldrichi Braund and McCullagh, Wilson Bull., 52 (2): 114, June, 1940.

DESCRIPTION.—Adults (sexes alike): Pileum and hind neck black; back olive gray, becoming buffy on rump; wing and tail slate color, their outer webs edged with pale gray or grayish white; chin and throat black, and feathers posteriorly margined or tipped with white; sides of head and of neck white, the white extending under the eye and forming a narrow stripe running to the bill; under parts white, sides and flanks tinged or washed with buff.

MEASUREMENTS.—Adult male (36 specimens): wing, 60–67.5 (65.1) mm.; tail, 58.5–66 (62.1); total culmen, 8.8–11.2 (10.2). Adult female (31 specimens): wing, 60–67 (63.4); tail, 57–64 (60.5); total culmen, 9.2–10.5 (9.9).

TYPE LOCALITY.—Quebec City, Quebec, Canada.

DISTRIBUTION.—Occurs *north* to Cape Breton Island, Prince Edward Island, southeastern Quebec, including Natashkwan River and Anticosti Island, southern and central-western Ontario, southern Manitoba, and northern Minnesota; *west* to northwestern Minnesota (Kittson County), southeastern Nebraska, occasionally (Omaha), and eastern Kansas; *south* to Kansas, central-eastern Missouri, southeastern Iowa (Burlington), central-western Illinois (casually), southern Indiana, northeast-central (Wayne County) and northeastern (Lake and Ashtabula counties) Ohio, northeastern (Erie County), and north-central (Clinton County) Pennsylvania; and *east* to southeastern Pennsylvania, New Jersey, New York (Long Island), coast of New England, and southern and northern Nova Scotia.

Wanders *south* to Washington, D. C., northern Virginia, and Maryland (Laurel and Baltimore regions) in winter.

REMARKS.—The Black-capped Chickadee was described by Linnaeus (1766: 341), and was based on Brisson's (1760: 553) description, with locality given as "in Canada." Oberholser (1937: 219) restricted the type locality to the city of Quebec, Quebec, and shortly thereafter Todd, independent of Oberholser's work, likewise restricted the type locality of this form to Quebec City, in the same paper in which his description of *anamesus* appeared. Although Brisson's type undoubtedly came from the vicinity of Quebec City, as cited by Oberholser and Todd, specimens that the writer has seen from this general region do not express the characters of *atricapillus* as well as do the birds

from farther south in the New England states. This apparently indicates that the birds from the now-accepted type locality of *atricapillus* are verging toward the bird from the southern James Bay region, *anamesus*.

Birds from south-central Pennsylvania (Carlisle) are apparently intermediate between this form and *practicus*, but are nearer the typical race. Some specimens seen from New Jersey and Massachusetts, although showing too much white on the edge of the secondaries and rectrices, show a tendency toward the Newfoundland bird, *frigoris*, in both the dark brown appearance of the upper surface and the deep brown wash on the sides and flanks, but apparently these birds have 'foxed' from age and exposure to light and air. Birds from Nova Scotia do show some slight approach to the Newfoundland race, but are closer to *atricapillus*.. Some specimens from Minnesota are somewhat intermediate, toward *septentrionalis*, but are nearer to the typical form. The specimen from Kittson County, in the extreme northwestern part of Minnesota, which is referable to *atricapillus*, represents the northwestern outpost of the range of this subspecies. One specimen in the Gabrielson collection (No. 3539) from the Huron Mountain Club, Upper Peninsula of Michigan, exhibits a considerable amount of white for *atricapillus*, but is too brownish above for *anamesus* and too small for *septentrionalis*.

Two specimens, reportedly from extreme central-western Ontario (Rat Portage and the north shore of Lake Superior, on the Canadian Pacific Railway) are, in appearance and size, *atricapillus*. One specimen in the United States National Museum from Selkirk Settlement, Manitoba, while apparently discolored from age and intermediate in size, has been allocated to this form.

Snyder (1928: 276 and 1938: 199) called breeding birds of this general region *septentrionalis*, but his measurements of worn breeding birds (average of five males: wing, 65.5 mm.; and tail, 66.5 mm.) seem to indicate that they are intermediate in size. Thus it would appear that the Rainey River district, the Lake Nipigon region of central-western Ontario, and the Lake St. Martin region of south-central Manitoba (Shortt and Waller, 1937: 35) is the area of intergradation between *atricapillus, anamesus*, and possibly *septentrionalis*.

Braund and McCullagh (1940: 114) described the bird from Anticosti Island on the basis of five worn breeding specimens, but, although the birds in question are slightly darker than *atricapillus*, the difference is insufficient to warrant recognition. No real difference in size was detected that could be used to differentiate these birds.

Perhaps if a good series of fresh autumn or winter specimens were available, it might be possible to differentiate the birds of this island from the birds of the adjacent mainland, but with specimens in such poor condition it is impossible to determine any sufficient difference.

One specimen from eastern Kansas is the eastern bird, while only one specimen of this form has been seen from Nebraska (Omaha). Specimens from Iowa (Burlington), seen by the writer, proved also to be of this race. DuMont (1934: 100) lists this form as breeding in all parts of the State of Iowa except the northwestern part, and two specimens for which he gives measurements (wing, 71.9; tail, 69.6; and wing, 72.6; tail, 66.8), from Woodbury County, appear to be, at least in size, the long-tailed form, *septentrionalis*, instead of *atricapillus*.

Ten specimens, taken in fall and winter, from Wooster, Wayne County, Ohio, are slightly intermediate, but definitely this form, and not the southern Appalachian race, *practicus*, as are the birds from Lake, Cuyahoga, and Ashtabula counties, according to Oberholser (1937: 220).

Brodkorb (1928: 512) recorded this chickadee as a wanderer or migrant in central-western Illinois in November and April (Eagle Township, Jersey County). Neff (1923: 215), in his account of the birds of the Ozark region of Missouri, records *P. a. atricapillus* as "very common," but this record apparently refers to *P. carolinensis*, as the Carolina Chickadee is not listed and it is probably a common bird in that area. Pindar (1925: 168) lists the Black-capped Chickadee from Fulton County, Kentucky, as a "rare winter visitant," but with nothing more substantial than the statement quoted above it is best to consider the species as not occurring there until more definite data are available to substantiate the occurrence of black-caps in Kentucky.

Baerg (1927: 548) states that the Black-capped Chickadee occurs on Mount Magazine, Logan County, Arkansas, but is relatively uncommon. However, he does not list the Carolina Chickadee, *P. carolinensis*, and without doubt the reference to *P. atricapillus* refers to *P. carolinensis*.

Bigelow (1902: 30) records the chickadee from Labrador, but later (1902: 202–206) corrected it as being *P. hudsonicus* [*littoralis*]. Turner (1885: 236) also recorded the black-cap from Labrador, but this record also is probably erroneous, as indicated by Austin (1932: 167).

Parus atricapillus practicus (Oberholser)
APPALACHIAN BLACK-CAPPED CHICKADEE

Penthestes atricapillus practicus Oberholser, Proc. Biol. Soc. Wash., 50: 219–220, 1937.

DESCRIPTION.—Similar to *P. a. atricapillus*, but darker and duller (more grayish); rump, sides, and flanks less buffy; edging of wing and tail less whitish (more grayish) and narrower.

MEASUREMENTS.—Adult male (12 specimens): wing, 61.5–67 (64) mm.; tail, 57–61.5 (59.9); total culmen, 9.3–10.5 (9.7). Adult female (12 specimens): wing, 59.5–65.5 (63); tail, 57–60.5 (59.3); total culmen, 8.9–10.5 (9.8).

TYPE.—Adult male, No. 340642, U. S. National Museum (Biological Survey Collection); Mount Guyot, 6,500 feet, Great Smoky Mountains, North Carolina; April 15, 1932; Thomas D. Burleigh; original number, 1797.

DISTRIBUTION.—Occurs *north* to southwestern (Somerset County) and central-western Pennsylvania, and the Appalachian Plateau of northeastern Ohio; *west* to central and south-central Ohio; *south* in the Appalachian Mountains, through western Maryland, eastern and southwest-central (Charleston) West Virginia, central-western Virginia, western North Carolina, and eastern Tennessee. Occasional in winter to the District of Columbia.

REMARKS.—Although Oberholser identified birds in worn breeding plumage from Somerset, Somerset County, Pennsylvania, as *atricapillus*, the writer has seen numerous birds in fresh plumage which clearly indicate that the birds of this region are the same as birds breeding in western North Carolina. The birds from farther north and east of Somerset County, in west-central Pennsylvania, although somewhat intermediate, also appear to be closer to the southeastern race. Specimens of *practicus* in worn breeding plumage generally are much darker than *atricapillus*, and, although the specimen from Centre County (Port Matilda), Pennsylvania, is from an intermediate locality, it is, in coloration, fairly typical of the southern mountain form, *practicus*, while the bird from Tamarack Swamp, in Clinton County, north-central Pennsylvania, is *atricapillus*.

One winter specimen from Circleville, Ohio (No. 235923, U. S. National Museum, December 6, 1881) is this form, while two others from the same locality, taken one day earlier, are the Carolina Chickadee (*P. carolinensis*). One immature specimen from Columbus, Ohio, collected about 1877 by J. M. Wheaton, has been previously identified as the Carolina Chickadee, but upon close examination it appears to be a race of the Black-capped Chickadee, because of the relatively broad whitish edgings of the secondaries, and a tail-length of 61 mm. At the present time the Black-capped Chickadee rarely occurs at Columbus (Thomas, 1928: 77), and has been supplanted by the Carolina Chickadee.

Two specimens from Athens, in southeastern Ohio, have been most difficult to allocate, as they exhibit some characters of the Black-capped Chickadee and some of the Carolina Chickadee. They have finally been determined to be the latter species, mainly on the basis of the short tail (55–56 mm.). Although specimens have not been seen from Geauga and Portage counties, in northeastern Ohio, according to Oberholser (1937: 220) they are *P. a. practicus.*

Parus atricapillus anamesus (Todd), CANADIAN BLACK-CAPPED CHICKADEE

Penthestes atricapillus anamesus Todd, Auk, 55 (1): 116–117, January, 1938.

DESCRIPTION.—Similar to *P. a. atricapillus* in size, but paler and less buffy above and below; edges of primaries, secondaries, and rectrices with greater extent of white. Similar to *P. a. septentrionalis,* but smaller; upper parts darker, and white of wings and tail not so extensive.

MEASUREMENTS.—Adult male (14 specimens—type series): wing, 63–67 (64.9) mm.; tail, 60–66 (62.6); total culmen, 9.8–11 (10.3). Adult female (12 specimens—type series): wing, 61.5–66.5 (63.4); tail, 58.5–63.5 (61); total culmen, 9–10.4 (9.8).

TYPE.—Adult male, No. 100002, Carnegie Museum; Mattice, northern Ontario; May 21, 1926; W. E. C. Todd.

DISTRIBUTION.—Occurs *north* to Fort Albany, Ontario, central Manitoba (Eichamanish River), northeast-central Saskatchewan (south end of Reindeer Lake), and northeast-central Alberta (Fort McMurray); *west* to central-western Alberta and central-eastern British Columbia (Moose Lake); *south* to central Alberta (S. Edmonton) and central-eastern Ontario (Mattice and Mattagami River); and *east* to west-central Quebec (Lake Mistassini).

REMARKS.—The birds from James Bay, as indicated by Todd in the original description of *anamesus,* exhibit some of the characters of *P. a. atricapillus* and some of *P. a. septentrionalis,* and, although intermediate, can be separated from the other races of this species. Taverner (1940: 536–541), in his recent discussion of the Black-capped Chickadees in Canada, says that Todd merely split the difference and doubled the difficulty when he named an intermediate, but from this present study it is apparent that *anamesus* can be identified in most instances and does have a considerable distribution across Canada. Taverner, in his study, had no specimens that he considered to be *anamesus,* but assumed that birds from west-central Canada were *septentrionalis* and that those from southeastern Canada were *atricapillus,* and on that basis came to the conclusion that there was such a great overlap that the bulk of the Canadian specimens could not,

with certainty, be identified. Nevertheless, had he used typical examples of *septentrionalis* from northeastern Montana and southward in the United States, he would, I feel sure, have recognized the distinctness of *septentrionalis* from the birds of the northern half of Alberta, Saskatchewan, and Manitoba, and the difference of the west-central Canadian birds from typical *atricapillus*. In an earlier paper, Taverner (1926: 103) gave the tail measurements of three specimens of chickadees from the Belvedere region of Alberta, on the basis of which birds of that region are considered to be the long-tailed form. The measurements, however, are entirely too small for that race and appear to indicate *anamesus*.

Specimens from Fort McMurray, Alberta, when compared with the type series of *anamesus*, are indistinguishable from it in both color and size, while specimens from South Edmonton and western Alberta, north and around Jasper House, are diverging slightly from *anamesus*, but are definitely that form and not *septentrionalis* of northeastern Montana. Specimens from Alberta, however, have on the average slightly longer tails than typical *anamesus*. Two freshly molted specimens from Moose Lake, British Columbia, are darker than *anamesus*, but definitely are not *fortuitus* of eastern Washington, and are too small and dark for *septentrionalis*. The above-mentioned birds heretofore have been identified as *septentrionalis*, but when compared with typical *septentrionalis* the differences are at once apparent.

Insufficient material has been seen from central and northern British Columbia to determine properly the race or races occurring there, for the only available material was one badly worn and mutilated specimen from the central part of the province (Stuart Lake), and several badly worn birds from the northern part of the province (Atlin). It may be that additional specimens will prove these birds to be separable as a new race, as intimated by Swarth (1922: 297).

Several specimens from northern Michigan show a trend toward *anamesus*, but they are closer to *atricapillus*, while specimens from southeastern Ontario likewise show some trend toward *anamesus*. The specimen from Lake Mistassini in west-central Quebec referred to by Macoun (1885: 34-D) has been allocated to this form on geographic grounds.

Parus atricapillus frigoris Selys-Longchamps
NEWFOUNDLAND BLACK-CAPPED CHICKADEE

Parus frigoris Selys-Longchamps, Bull. Acad. Roy. Sci. Bruxelles, 10 (7): 27, July, 1843.

Penthestes atricapillus bartletti Aldrich and Nutt, Sci. Publ., Cleve. Mus. Nat. Hist., 4 (2): 13–14, 1939. (Type: adult male, No. 38031, Cleve. Mus. Nat. Hist.;

Makinson's Grove, Avalon Peninsula, southeastern Newfoundland; September 6, 1938; R. Hellman and D. C. Nutt; original number, 293.)

DESCRIPTION.—Similar to *P. a. atricapillus,* but upper parts, sides, and flanks decidedly darker and browner. Similar to *P. a. occidentalis,* of the Pacific Coast, but larger and not so dark.

MEASUREMENTS.—Adult male (7 specimens): wing, 65–68 (66.4) mm.; tail, 59–64 (62.4); total culmen, 10.5–11.2 (10.7). Adult female (6 specimens): wing, 61–64.5 (62.3); tail, 57.8–61.5 (60); total culmen, 10.2–11 (10.7).

TYPE LOCALITY.—St. John's, Newfoundland.

DISTRIBUTION.—Known only from Newfoundland and recorded from the following localities: Avalon Peninsula (Aldrich and Nutt, 1939: 13–14); St. John's (Brooks, 1936: 344, and Palmer, 1890: 265); Great Rattling Brook (Rooke, 1935: 871); Harry's River (Oberholser, 1914: 43); Bard Harbor (Griscom, 1926: 682); Nicholsville, Port au Port, Lewis Hills, and Spruce Brook (Noble, 1919: 564), and recorded on August 14, 1833, from St. George's Bay, by Audubon; also from Stephenville, on June 9, 1911, and Bay of Islands, on June 3, 1911 (Beers, *In* Migration Reports to Bureau of Biological Survey—now Fish and Wildlife Service).

REMARKS.—Selys-Longchamps (1843: 27) named and described a chickadee which he believed to be from Iceland. At a later date (1884: 54) he corrected the locality to "États-Unis" [United States], and considered the bird in question to be a form of *atricapillus,* race *septentrionalis,* because of the "long tail," notwithstanding the fact that the color characters were totally different and unlike those ascribed to *septentrionalis.* Fraipont (1910: 5, 65) reiterates Selys-Longchamp's corrected locality for the type, as from the United States of America. Hellmayr (1903: 56) likewise tentatively placed *frigoris* under *septentrionalis.*

A. J. van Rossem, who visited Brussels in July, 1939, was given access to the Selys-Longchamps collection, at which time he made critical notes on the type of *Parus frigoris.* As a result of this careful study, van Rossem (1942: 312–313) has concluded that the type of *frigoris* is typical of the birds inhabiting Newfoundland, both as to size and color. Thus, as van Rossem suggests *(loc. cit.), Parus frigoris* Selys-Longchamps replaces *P. a. bartletti* Aldrich and Nutt, who were the first since Selys-Longchamps to point out the distinctness of the Newfoundland bird. Because the French scientific expedition which obtained the type of *frigoris* probably visited the port of St. John's, and because *frigoris* reaches its greatest differentiation in southeastern

Newfoundland, the type locality is restricted to St. John's, Avalon Peninsula, Newfoundland.

Parus atricapillus septentrionalis Harris, LONG-TAILED CHICKADEE

Parus septentrionalis Harris, Proc. Acad. Nat. Sci. Phila., 2 (12): 300, November–December, 1845 [after February 18, 1846].

Parus albescens Baird, Rep. Expl. and Surv., Pac. R. R., 9: xxxvii, 1858 (Rocky Mts.; nomen nudum, characters given without name on page 389 in text).

DESCRIPTION.—Similar to *P. a. atricapillus,* but wing and tail decidedly longer; upper and lower parts lighter; edges of primaries and tail feathers much more purely white and more extensive. Similar to *P. a. anamesus,* but larger and paler.

MEASUREMENTS.—Adult male (62 specimens): wing, 64.5–73 (68.7) mm.; tail, 63–72.5 (67.4); total culmen, 9.6–11.4 (10.5). Adult female (30 specimens): wing, 64–71 (67.2); tail, 64–71 (64.2); total culmen, 9.6–11.2 (10.5).

TYPE.—Immature, No. 29792, Acad. Nat. Sci. Phila.; Yellowstone River, about 30 miles "below" [= above] its junction with the Missouri River in northeastern Montana; July 26, 1843; Edward Harris.

DISTRIBUTION.—Occurs *north* to central-northern North Dakota and northern Montana; *west* to west-central Montana, eastern Idaho (Lemhi), western Wyoming (except extreme southwestern part of the State), southwestern Colorado, and northwestern New Mexico; *south* to north-central New Mexico, central-southern Kansas, and northeast-central Oklahoma (casually); and *east* to southeastern Kansas, central-western Missouri (Independence, No. 7531, U. S. National Museum, May–June, 1857, J. G. Cooper), eastern Nebraska, west-central Iowa (DuMont, 1934: 101–102), eastern South Dakota, and eastern North Dakota. In winter, wanders occasionally to central Idaho.

REMARKS.—Birds from Gallatin County, southwestern Montana, are different from almost all other specimens of *septentrionalis* that the writer has seen, being much buffier both above and below, and darker than topotypical examples of *septentrionalis.* Birds from farther south, at Teton Pass (Fish Creek), in central-western Wyoming, show the other extreme and are typical of this race. One specimen in fresh plumage, from Lemhi, Idaho, is apparently this race; it certainly is not *nevadensis* or the central Washington bird, *fortuitus.*

Baird (1858: xxxvii) included in his table of contents the name *Parus albescens,* and on page 389 characterized U. S. National Museum specimen No. 6776, but failed to give it a name, thereby making *albescens,* as listed in the table of contents, a nomen nudum, which was so indicated by Ridgway (1904: 401). The above name, *albescens,*

by inference and number given, refers to a flat skin in very poor condition, very buffy both above and below, which may be due to 'foxing.' Although taken in New Mexico, it is very different from practically every other specimen with the exception of one from Pecos, New Mexico, and several fresh-plumaged birds from Colorado. Apparently the above-mentioned birds are merely variants of *septentrionalis.* Specimens from Willis, New Mexico, taken during the breeding season, are somewhat darker than *septentrionalis,* and thus show a trend away from that race, as well as away from *nevadensis.* In addition, other specimens from New Mexico show a departure from the long-tailed form in their smaller size.

The specimen (No. 186868, U. S. National Museum, Biological Survey Collection) listed by Mrs. Bailey (1928: 506) as *P. a. septentrionalis,* from the Capitan Mountains, in south-central New Mexico, proves to be a worn specimen of *P. gambeli* rather than of this species. It is interesting to note that Mrs. Bailey did mention the fact that the specimen in question was from considerably south of the normal range of this form which therefore must be rare or accidental at that place.

Specimens in fresh plumage from Colorado are similar to the birds from Gallatin County, Montana, in having a buffy wash to the upper parts, thus averaging more buffy than typical *septentrionalis,* and, at the same time, are different from specimens from southern Idaho and Nevada.

A specimen (No. 31282, Cleveland Museum of Natural History) from near the mouth of Camas Creek, Mud Lake, Jefferson County, Idaho, is a typical example of this race, being too buffy (less grayish) and too dark for *nevadensis,* and is apparently a wanderer of *septentrionalis.*

Mrs. Nice (1931: 131) records a specimen of this race from Tulsa, Oklahoma, as well as several sight records from that State.

In every case but one, birds from Nebraska have been allocated to this race, although some specimens do show, in color, some approach to *atricapillus,* while in the amount of white in the wing and tail, and in size, they are *septentrionalis.* One specimen in particular, from Valentine, Nebraska, in the central-northern part of that state, is like *atricapillus* in coloration, but the white edges of the wing feathers are too extensive for the eastern bird. Also, while wing and tail measure only 65 mm., the specimen is much worn and abraded, with several tail feathers missing; the wing and tail no doubt would have been considerably longer in good plumage. Another specimen from

the same locality is ultra-typical, both in size and color, being pale grayish buff on the upper surface and showing much white on the edges of wing and tail; the wing measures 73 mm. and the tail, 72.5 mm. Oberholser has identified the first-mentioned (Valentine) specimen as *atricapillus,* but because of the facts as given above the intermediate specimen has been called *P. a. septentrionalis.*

Parus atricapillus nevadensis (Linsdale), PALLID BLACK-CAPPED CHICKADEE

Penthestes atricapillus nevadensis Linsdale, Condor, 11 (1): 36–38, January, 1938.

DESCRIPTION.—Similar to *P. a. atricapillus,* but larger and paler, more grayish (less brownish), and white edgings more extensive. Similar to *P. a. septentrionalis,* but more grayish, both above and below.

MEASUREMENTS.—Adult male (22 specimens): wing, 64–72.2 (68) mm.; tail, 64–71.6 (67.5); total culmen, 9.6–11 (10.2). Adult female (13 specimens): wing, 63.5–70.5 (66.9); tail, 63.5–70.5 (67); total culmen, 9.7–10.8 (10.1).

TYPE.—Adult male, No. 65920, Museum of Vertebrate Zoology; Salmon River at Shoshone Creek, 5,000 feet, Elko County, Nevada; September 16, 1934; J. M. Linsdale.

DISTRIBUTION.—Occurs *north* to southern and central-eastern Idaho; *west* to northeastern Nevada; *south* to north-central Utah; and *east* to extreme southwestern Wyoming. Wanders in migration to Zion Canyon in southwestern Utah (Presnall, 1936: 217) and central-northern Arizona (Weatherill, 1937: 86).

REMARKS.—This race is one of the palest of the known races of the species, inhabiting the Great Basin area, and in certain plumages is very close to the Alaskan race, *turneri.*

Specimens collected by Dr. Clarence Cottam in the Raft River Mountains, in northwestern Utah, are this form, as are also specimens from Salt Lake City, Provo, and Laketown, Utah. Two old specimens from Green River, in eastern Utah, are very brown and certainly do not appear to be this race, but since birds both from north and west are of this race, and inasmuch as these Green River specimens probably have 'foxed' with age and exposure to light and air, they are hereby placed with *nevadensis.* Birds from southwestern Wyoming (Fort Bridger, Green River, and Mountain View) are all *nevadensis* and, together with the specimens from northeastern Utah (Laketown) and eastern Idaho, represent the eastern part of its range.

Parus atricapillus fortuitus (Dawson and Bowles),
COLUMBIAN BLACK-CAPPED CHICKADEE

Penthestes atricapillus fortuitus Dawson and Bowles, Birds of Washington, 1: 273–274, 1909.

DESCRIPTION.—Similar to *P. a. atricapillus,* but paler and more buffy both above and below; white edgings of wing and tail more conspicuous. Similar to *P. a. nevadensis* and *P. a. septentrionalis,* but smaller and darker; white edgings much reduced. Larger and not as dark brown, both above and below, as *P. a. occidentalis.* Paler and more buffy than *P. a. anamesus.*

MEASUREMENTS.—Adult male (27 specimens): wing, 60–67 (64.1) mm.; tail, 57.5–65 (62.1); total culmen, 9.1–10.8 (9.8) Adult female (23 specimens): wing, 59–67 (63.2); tail, 57–65 (61.4); total culmen, 9.1–10.5 (9.8).

TYPE LOCALITY.—Walla Walla, Washington.

DISTRIBUTION.—Occurs *north* to extreme northwestern Montana (Waterton Lake), northern Idaho, southeastern and central-southern British Columbia (Okanagan Valley); *west* to west-central (east of Cascades) and south-central Washington, and east-central Oregon; *south* to southeast-central Oregon and central Idaho; and *east* to extreme central-western Montana (Corvallis).

REMARKS.—Many ornithologists have discussed the birds from the general region of eastern Washington and Oregon, western Idaho, and southern British Columbia, but apparently none have felt that they possessed sufficiently different characters to warrant naming. Birds inhabiting this region, however, are distinct enough to be recognized, and Dawson and Bowles (1909: 273–274), referring to the birds from this particular region, suggested that if they are recognizable they should be called *fortuitus,* and gave both the range and characters for this 'colony' or 'island' of chickadees. They characterized the birds, saying that they "are notably larger and brighter than *P. a. occidentalis.*" Thus it is apparent that the name *fortuitus* is a valid one and must be used for the present race.

Brewster (1882: 228) appears to have been the first to discover and point out that these birds are unlike their nearest relatives, *occidentalis* and *septentrionalis,* and most like the eastern race, *atricapillus.* The specimens upon which he based his findings were from a large collection of birds sent to him for study and comment by Captain Charles E. Bendire, from the immediate vicinity of Fort Walla Walla, in southeastern Washington. Dawson and Bowles (1909: 274) gave the range of this form by merely quoting from Ridgway (1904: 398), who first listed Walla Walla as one of the places of occurrence. The Walla Walla specimens in the U. S. National Museum, which were examined at that time by Mr. Ridgway, were perhaps some of the same lot of specimens which Bendire had originally sent to Brew-

ster. Therefore, the type locality of *fortuitus* is restricted to Walla Walla, in southeastern Washington. It is interesting to note that Ridgway, when preparing the measurements for the Black-capped Chickadee in his Birds of North and Middle America, had placed, at the heading of the sheet containing the measurements of the twelve specimens considered to represent an isolated colony of eastern-type birds, a new name. Apparently he changed his mind afterward, for in his publication he grouped these birds under typical *atricapillus,* and the new name was never published. Later, George G. Cantwell collected a Black-capped Chickadee in the willows at Yakima, Washington, on March 15, 1921, and he, too, noted a difference in the population of chickadees from east of the Cascades, for, in his unpublished field notes in the files of the Fish and Wildlife Service, he states: "Specimens from this locality [Yakima] are too light colored to be typical *occidentalis,* and not large or bright enough to be classed as *septentrionalis.* A good series of birds from this arid east side would probably show some interesting features."

Birds from southeast-central Oregon, in the Steens Mountains and vicinity, and Camp Harney are somewhat intermediate and show a tendency toward *nevadensis,* but apparently are closer to *fortuitus.* Some birds from central-eastern and northeastern Oregon likewise exhibit variable characters, and show a tendency toward both *nevadensis* and *septentrionalis.* Some specimens from northeastern Washington appear almost identical to birds from the humid Pacific coast region, being very brown both above and below, yet they are too large for *occidentalis.* Apparently this is an indication of an approach toward *occidentalis.* However, populations in this region are completely cut off from the coast birds by areas inhabited by typical *fortuitus,* and since other specimens from the same localities are typical *fortuitus,* the tendency of the above-mentioned examples toward more brownish coloration seems best explained as a local variation of the interior race.

Specimens from Sicamous, in south-central British Columbia, while not as dark nor as brown as birds from the coast, do show a tendency in that direction, as do also some specimens from Loomis and Molson in central-northern Washington, but all are typical in size of the east Washington birds and are thus placed with that form.

Birds from west of Sicamous, at Ashcroft, British Columbia, are typical *fortuitus.* Specimens from central-western and northern Idaho (Payette, Idaho City, and Fort Sherman) are all *fortuitus,* while the form breeding in southwestern and central Idaho (Wood River and

Ketchum) is undetermined, inasmuch as no specimens have been examined from these regions. They may prove to be this form or *nevadensis*. Examples from Benton County, Washington, are typical *fortuitus* and thus represent the extreme southwestern portion of its range in Washington.

One specimen from Waterton Lake, northwestern Montana, and one from Corvallis, in central-western Montana, are this form. Saunders (1921: 160) referred birds from this general region to *atricapillus*, as well as a specimen taken at Bozeman, in southwestern Montana, which he considered a wanderer or migrant (1911: 48). In a letter from A. A. Saunders to Mrs. Florence Merriam Bailey, dated December 16, 1918, in relation to chickadees of Glacier National Park, he stated: "Those west of divide probably *atricapillus*, and east *septentrionalis*, as in other places near the Park."

Parus atricapillus occidentalis Baird, OREGON CHICKADEE

Parus occidentalis Baird, Rep. Expl. and Surv. R. R. Pac., 9: xxxvii, 388, 391, 1858.

DESCRIPTION.—The darkest and brownest of all North American races of chickadee, differing so radically from most of the known races that no comparison is necessary, with the exception of the Newfoundland bird, *frigoris*. Differs from *frigoris* in being slightly darker, both above and below, and with the tail decidedly smaller.

MEASUREMENTS.—Adult male (41 specimens): wing, 57.5–64 (61.2) mm.; tail, 53.5–60.5 (57.1); total culmen, 9.5–10.9 (10.2). Adult female (35 specimens): wing, 57.5–63.5 (60); tail, 53–59.5 (56); total culmen, 10–10.8 (10.3).

TYPE LOCALITY.—Shoalwater Bay, southwestern Washington. Designated by American Ornithologists' Union (1931: 229).

DISTRIBUTION.—Occurs *north* to extreme southwestern British Columbia and the Pacific coast of Washington and Oregon, west of the Cascade Mountains; *south* to northwestern California (casually); and *east* in Washington up the Columbia River to Roosevelt, and south through west-central Oregon to Jackson County, and central-northern California (casually).

REMARKS.—A specimen from Roosevelt on the Columbia River, in central-southern Washington, is typical of the coast bird, and apparently shows an infiltration of this race into the interior lowlands up the Columbia River. A little farther west and north of Roosevelt, birds from Benton County (Prosser) are representative of *fortuitus*, thus indicating the limits between these two races in central-southern Washington. Birds from Warm Springs, in north-central Oregon, are intermediate but apparently are closer to the coast race, and show

a movement from the Columbia River south and east of the Cascades. Several specimens from Ashland, Jackson County, in southwestern Oregon, resemble *fortuitus*. Examples from localities entirely surrounding this area are typical *occidentalis*. Thus the Ashland birds are considered as variants of the coastal race. The several specimens reported as seen and collected in California have not been examined by the writer, but apparently, on geographic grounds, they should be referable to *occidentalis*. These California records are from: Eureka, seen, March 26; 1 male taken, March 31, 1920, and another on October 23, 1924 (Davis, 1924: 105; 1940: 222); and Scott River, 6 miles northwest of Callahan: 4 specimens (2 juveniles) in the collection of the Museum of Vertebrate Zoology, Berkeley, California, taken June 10 and 13, 1911 (Grinnell, 1915: 163). In addition, Baird, in his original description of *occidentalis*, listed specimen No. 9219, from California, which was sent by him to H. K. Coale, November 24, 1884. This was from the Gould collection, collected by D. Douglas, and may or may not have been collected in what is now known as California. Gadow (1883: 46) also lists a specimen from California as received from John Gould. Specimen No. 6768, from Shoalwater Bay, Washington (cotype), was sent to P. L. Sclater, in England, and No. 4538, from Washington Territory (another cotype), was sent to G. N. Lawrence, both in 1859.

Parus atricapillus turneri Ridgway, YUKON CHICKADEE

Parus atricapillus turneri Ridgway, Proc. Biol. Soc. Wash., 11: 89, April 10, 1884.

DESCRIPTION.—Similar to and almost indistinguishable in color from *P. a. nevadensis*, though smaller and more purely grayish (practically no buffy wash). Similar to *P. a. septentrionalis*, but averaging smaller and grayer.

MEASUREMENTS.—Adult male (20 specimens): wing, 61–68 (65.4) mm.; tail, 62–70.5 (65.7); total culmen, 9.2–10.5 (9.9). Adult female (15 specimens): wing, 61–66.5 (63.6); tail, 61–66 (63.7); total culmen, 9.5–10.7 (10).

TYPE.—Adult male, No. 70826, U. S. National Museum; St. Michael's [St. Michael], Alaska; May 1, 1876; L. M. Turner, original number, 1091.

DISTRIBUTION.—The coast of Alaska *north* to St. Michael; *west* to the Aleutian Islands (Shumagins, etc.), Kodiak Island; *south* to southeastern Alaska (Haines), northern British Columbia (Atlin), southern Yukon, and central-southern Mackenzie; and *east* to Great Bear Lake in west-central Mackenzie (Preble, 1908: 485–487). In migration, to Nunivak Island, central-western Alaska (Swarth, 1934: 42); accidental in winter in northwestern Alaska (Hunt River).

REMARKS.--This race and *P. a. nevadensis* exceed in pallor all other known races of chickadee in North America, and show an interesting parallel development, as do also *fortuitus* and *atricapillus*. Both the Alaskan race and *nevadensis* are widely separated from each other, yet in certain plumages are very difficult to separate.

Although tentatively placed under this form, specimens from southern Mackenzie are intermediate between *turneri* of Alaska and *anamesus* of central Canada, and thus appear like *septentrionalis* in color, while exhibiting a very variable size, from quite small to very large. Two immature specimens from central-southern Yukon, near the British Columbia border, also have been placed tentatively with this race, even though these immature birds are noticeably lighter and browner than specimens of *turneri* from Kodiak Island, Alaska, which makes them look like specimens of *septentrionalis*. An adult male from the same region has likewise been placed under this form because it is too badly worn and abraded for certain subspecific identification.

Worn breeding examples from Haines, Alaska, and Atlin, British Columbia, also are unidentifiable, and the writer feels that the true status of the chickadees inhabiting Yukon, the northern half of British Columbia, Mackenzie, and southeastern Alaska, has not yet been satisfactorily determined, due to the lack of sufficient material. They may represent an undescribed race, as previously mentioned under *P. a. anamesus*.

Grinnell (1900: 59) secured two specimens on October 26, 1898, from the Kotzebue Sound region (Hunt River), Alaska, one of which was seized by a shrike while on a willow branch. The other specimen was identified by Robert Ridgway, who stated that it agreed in coloration with typical examples of *septentrionalis*, and that it was not referable to *P. a. turneri* of the Alaska coast. Nevertheless, Ridgway (1904: 402) placed the above-mentioned record under *turneri* in the synonymy of that race. It may be that Mr. Ridgway had forgotten about identifying the Hunt River skin for Grinnell, and allocated it on purely geographic grounds, for birds from east of there in east-central Alaska are *turneri*. It thus would seem that the bird in question is simply a variant of *turneri* and is so considered.

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THE PTERYLOSES OF SOME AUSTRALIAN BIRDS

BY HUBERT LYMAN CLARK

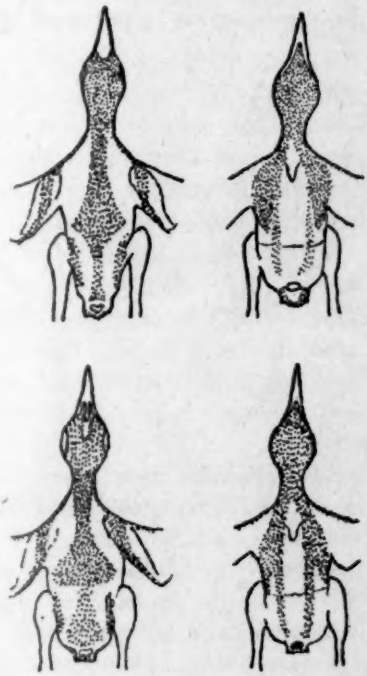
WHEN I was last in Australia, a few birds "in the flesh" came into my hands and these I brought back to Cambridge in alcohol with the idea of examining their pteryloses. Pressure of other work has hitherto prevented my giving any attention to this material but at last it has been examined. Mr. James L. Peters has very kindly identified the birds, and I am glad to express here my thanks for this very necessary assistance.

There are single specimens of each of six species and three specimens of another, but one of the seven is the well-nigh cosmopolitan plover, *Pluvialis dominica,* of which the subspecies *fulva* is a winter visitor in Australia. As its pterylosis was described and well-figured by Nitzsch over a hundred years ago, there is no need of further reference to it here. The remaining six species represent six characteristic Australian genera, of which three are relatively large (or at least, not small) black and white birds and three are very small, strikingly colored or variegated forms. Of one of the black and white species, the pterylosis has been described and figured, but the other five genera have not hitherto been studied in this particular.

In the 'Emu' for July, 1914, Dr. J. A. Leach published a very detailed account of the myology of the Bell Magpie, *Strepera graculina,* a black and white bird some 18 inches long. He adds some notes on certain points in the anatomy and gives a good though brief description and three figures of the pterylosis. The specimen at hand leads me to be critical of those figures. The dorsal pterylosis of *Strepera* is very similar to that of the Lyre Bird (*Menura*) but expands and ends just above the big oil-gland. The femoral tracts are very large, about 35 mm. long and 10 mm. wide at each end; near the middle the width is increased to 15 mm. as the feathers extend over onto the back of the tibia. Connection with the end of the dorsal tract is very incomplete; only a few scattered contour feathers occur there. The humeral tracts, as Leach shows, are notably long, narrow, and well-defined. The sternal and ventral tracts do not appear to be as figured by Leach but are strikingly like Nitzsch's figure of those in the Greater Bird-of-Paradise (*Paradisaea apoda*). The increased density of the outer side of each sternal tract is notable. Aftershafts on the contour feathers are wanting and down feathers and filoplumes are inconspicuous. The oil-gland is nude. There are twelve rectrices with ten upper coverts; the under tail-coverts are numerous, forming a wide V-shaped patch with a conspicuous apterium right behind the anus. The wings are

quincubital with ten primaries and ten secondaries. Apparently the pterylosis of *Strepera* allies it with the Paradisaeidae, but too little is known of the diversity in that family to warrant any emphasis on the point.

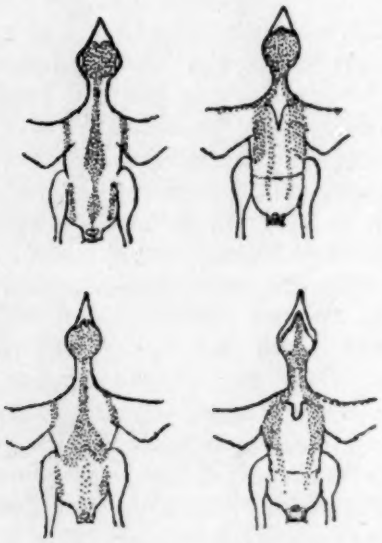
A second black and white bird at hand is the Pied Butcher-bird, *Cracticus nigrogularis,* widely distributed throughout Australia. The pterylosis is surprisingly like that of *Strepera,* but the humeral and femoral tracts are shorter, narrower, and less densely feathered. The sternal and ventral tracts do not merge so completely but are more as Nitzsch figures them in *Motacilla,* and the long, lateral cervical apteria are also as in that bird. In absence of aftershafts and oil-gland tuft, in the quincubital wing and presence of ten primaries and ten secondaries, and in the twelve rectrices with only ten upper coverts, are further, but not significant, resemblances to what is found in *Strepera.* On the whole, we can only consider the pterylosis as having little that is distinctive or notable.



TEXT-FIGURE 1.—Pterylography of *Strepera graculina* (upper fig.) and *Grallina cyanoleuca* (lower fig.).

The third black and white bird is the widely distributed and very characteristic Australian Magpie-Lark (*Grallina cyanoleuca*). Leach (Australian Bird Book, 6th ed: p. 148, 1926) says that its "scientific position is disputed." He follows Sharpe in placing it in the family Prionopidae, but adds that it may be "its position is not finally settled yet." The general pterylosis is similar to that of *Cracticus* but the tracts are narrower and more sharply defined and there are noticeable differences in the dorsal and ventral tracts. The head is rather fully covered with feathers which, on the forehead, form eight definite longitudinal series, four on each side running down to the nostrils. Between the eyes the series are crowded though distinct, but on the occiput they separate from each other and the feathers in

each series are rather widely spaced. At the base of the culmen is a notable triangular apterium. The cephalic end of the neck is thickly feathered, but basally there are large apteria on each side and also on the throat. The dorsal tract is thickly feathered and conspicuous. In form it is intermediate between *Motacilla* and *Hirundo* as figured by Nitzsch; that is, the outer angles of the anterior half of the tract are thickly feathered while the posterior half is abruptly narrow and the feathers are more widely spaced; indeed, there are but few feathers at the center of the area where widest. Removal of eight to ten feathers there would give a bilobed tract like that in *Hirundo*. These imperfect lobes are densely feathered but not sharply defined. The posterior dorsal tract increases in width over the sacrum and then narrows abruptly to end at the base of the oil-gland. At the anterior end of the sacrum it is about 6 mm. wide, but at the posterior end it is nearly eighteen. Its outer angles do not, however, reach the posterior ends of the well-marked, somewhat trigular femorals. The humerals are narrow but conspicuous, though distally they taper off markedly. The sternal tracts are thickly feathered and extend backward and outward to a point about 15 mm. in front of the femur. On the outer side distally a few scattered contour feathers connect the tract with the lower surface of the humerus, but the three specimens at hand (two males and a female) show considerable diversity in this detail—a diversity not associated with sex. On the breast, the ventral tracts merge with the sternals anteriorly, but the portion where they are distinctly separated is about as extensive as the united portion. On the belly, posterior to the sternum, the ventral tracts decrease steadily in width, and only a single line of feathers reaches the anus. The upper surface of the wing between shoulder and wrist is well covered with about twenty short parallel rows of contour



TEXT-FIGURE 2. — Pterylography of *Taeniopygia castanotis* (upper fig.) and *Dicaeum hirundinaceum* (lower fig.).

feathers. Aftershafts are present on the contour feathers and there is considerable down on the apteria and many filoplumes on the tracts. The oil-gland is nude. There are twelve rectrices, with only ten upper coverts. The wings are quincubital with ten primaries and nine secondaries.

While this pterylosis is reasonably distinctive, it cannot be affirmed that it throws much light on the affinities of *Grallina*. The well-developed aftershaft and presence of down feathers on apteria may properly be considered as primitive features. The general pterylosis is suggestive of two quite different groups of Passeres—the swallows and the tyrant flycatchers. The suggestion of a bilobed dorsal tract like that of the swallows has already been mentioned, and the triangular apterium at the base of the culmen on the front of the forehead is also a feature of some swallows (*Stelgidopteryx*). On the other hand, the sternal-ventral tracts and the large femorals are suggestive of some tyrant flycatchers such as *Sayornis*. It may be mentioned further that Nitzsch's figure of the pterylosis of *Bucco armillaris* is very suggestive, for if the tracts of that bird were considerably more fully feathered, the resemblance to *Grallina* would be striking. No Australian bird, whose pterylosis is known, shows any close resemblance in this respect to the Magpie-Lark.

The three small birds were all caged birds at Broome but were reported to be from the Northern Territory. They represent three characteristic Australian genera, two of the family Ploceidae and one of the family Dicaeidae. The last is the Mistletoe-bird (*Dicaeum hirundinaceum*) which ranges from India to southern Australia. It is reputed to be "fairly common" but "rarely seen" in Australia. The pterylosis, as shown by the specimen at hand, is interesting and distinctive. The feathers on the back of the head are widely spaced but those on the forehead form a rather dense patch extending to the bill but with a small though definite apterium at the base of the culmen. The upper cervical tract is very narrow and passes into the dorsal tract, which is bilobed as in the swallows (*See* Nitzsch, pl. 3, fig. 14). The posterior dorsal tract is very weak and ill-defined; it hardly reaches either the main dorsal tract or the oil-gland. The humerals are narrow and well-marked but do not extend downward towards the elbow. The lower cervical tract is narrow but extends to the gonys with apteria on both sides; it is deeply forked and the branches pass directly into the well-marked sternals, which extend nearly to the knee. There is hardly so much as a notch where the ventrals and sternals unite and the ventrals are weak and do not

reach nearly to the anus. The under coverts form a very conspicuous V-shaped patch behind the anus, enclosing a triangular apterium. The femorals are short and small but well-marked. There are nine primaries but only eight secondaries in the quincubital wing. There are twelve rectrices but eleven upper coverts; probably ten is the normal number, but in this individual there is a definite covert over the first rectrix of the left-hand side. Aftershafts are wanting, and the oil-gland is nude. Down feathers are few, and filoplumes, though not abundant, are very slender and dark-colored. The resemblance to swallows in the bilobed dorsal tract and the small triangular apterium at the base of the bill is notable, although Leach says *Dicaeum* "is not related to the swallows" even though the specific name is *hirundinaceum!*

The two remaining birds are little weaver-finches, representing two related genera, both of which are popular as cage-birds because of their pretty plumage and sprightly habits. The species at hand are *Taeniopygia castanotis* and *Poephila gouldiae,* strikingly different in coloration but surprisingly similar in pterylosis. None of Nitzsch's figures represent it very exactly but those of *Oriolus galbula* (pl. 3, figs. 7 and 8) will serve as a basis for comparison. Dorsally the cervical, humeral, and femoral patches of Nitzsch's figure do very well, but the dorsal tract in the Australian finches is interestingly different. The elliptical tract is more anterior than in *Oriolus* and is much shorter, while the posterior portion of the tract is much longer; it is narrow at first but widens into a small secondary ellipse and narrows again to barely reach the oil-gland; indeed it completely runs out. Ventrally, Nitzsch's figure 7 answers very well, save for the fact that the tracts in the Australian finches are narrow and are much more sparsely feathered. The under tail-coverts form a conspicuous V-shaped patch much as in *Dicaeum.* There are twelve rectrices but only ten upper coverts. There are nine primaries and nine secondaries. Aftershafts, if present, are weak and down is scanty. Filoplumes are also few, delicate, and light-colored. The oil-gland is nude.

The above notes are offered in the hope that their publication will help stimulate further study in this interesting side line. Birds which were not examined by Nitzsch deserve particular attention and the Australian avifauna is a very inviting field.

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THE EFFECT OF AUDITORY STIMULATION ON THE SPERMATOGENETIC CYCLE OF THE MALE ENGLISH SPARROW

BY C. S. THORNTON AND S. B. CUMMINGS, JR.
ASSISTED BY FREDERICK GREELEY

In recent years, many investigators have clearly demonstrated the importance of environmental factors in initiating and controlling the sexual cycle in a large number of fish, reptiles, birds, and mammals. According to the most widely accepted hypothesis (Bissonnette, 1936; Marshall, 1936) these environmental factors stimulate the anterior pituitary periodically to produce an increased amount of gonadotropic hormone which, in turn, causes seasonal changes in the sexual mechanism. These changes include hypertrophy of the gonads, active spermatogenesis and various secondary sexual changes in coloration and plumage. The question at issue is concerned with the factors which arouse the cyclic activity of the pituitary gland of the bird.

According to one theory (Bissonnette, 1931, 1932), an increase in the daily light ration is essential to the appearance of the seasonal sexual changes in birds. According to a second theory, the "activity" theory of Rowan (1938a, b), light rays are not directly responsible for, nor even essential to, the occurrence of these changes. Rowan's theory assumes that an increase in bodily activity produces metabolic and hormonal changes which, in their turn, stimulate the sexual mechanism. Accordingly, various environmental agencies, as long as they cause heightened activity in the animal, can be effective in producing the seasonal sexual changes.

As one line of evidence in support of this view, Rowan (1938b) reports some observations which indicate that London Starlings become sexually active several weeks in advance of country birds. He attributes this difference primarily to the sounds of city traffic which keep the birds in a state of prolonged wakefulness and agitation.

However, Bissonnette (1932), Riley (1940), and Kendeigh (1941) have proved without doubt that exercise has no effect on the avian sexual cycle. Rowan's explanation of the premature sexual activity of the city Starlings would consequently appear inadequate. Kendeigh (1941) has suggested that the enforced wakefulness of the city birds has allowed them to respond to the feeble illumination of the street lights.

Nevertheless, the possible effectiveness of the auditory pathway as a mechanism which may control sexual periodicity has not been sys-

tematically investigated. Such an investigation becomes all the more necessary in view of the fact that Whitaker (1940) has reported incidental observations indicating that white-footed mice become sexually active at a premature date in a noisy laboratory environment. Accordingly, we have undertaken experiments designed to test the effectiveness of sound in initiating and controlling the sexual cycle of the male English Sparrow. A preliminary report of the results of these experiments has already appeared (Cummings and Thornton, 1941).

PROCEDURE

Groups of male sparrows were captured in mid-November during their sexually quiescent period. They were housed in screened wooden cages, 3′ × 2′ × 16″ in size. All birds were maintained on a diet of scratch feed which had been passed through cod liver oil. They remained healthy and active during the experimental period, which lasted 40 days.

An experimental group of seven birds was isolated in a separate room and subjected to an intermittent noise from a small commercial buzzer throughout the 40-day period. The buzzer was connected to a circuit-breaker in such a way as to provide one second of sound stimulation followed by one second of silence. This form of stimulation continued for 15 hours each day for the duration of the experiment. The buzzer operated at a noise level of 50–60 decibels above the human auditory threshold. The experimental group of birds was allowed only the normal winter ration of daylight during the experiment.

Two control groups of sparrows were also observed over the same period. The first control group of four sparrows was subjected to 4.5 hours of artificial light in addition to the normal amount of daylight of the winter season, which was 9.4 hours in the latitude of Gambier, Ohio. Since it has been shown by other investigators (Kirschbaum and Ringoen, 1935; Riley, 1936) that the sparrow is responsive to light treatment, this control group served as a check on the physiological condition of the colony and also provided a basis of comparison for the sexual condition of the sound-stimulated group. These controls received no form of sound treatment and were kept in an isolated and quiet room.

A second small group of three sparrows was subjected to no added amounts of either sound or light. They represented birds in the normal quiescent condition and formed a second basis of comparison for the sound-stimulated group. While outside birds would probably

have served just as well, it was thought best to take the precaution of using captive laboratory birds in case some unforeseen stimulating factor might be operative in causing spermatogenesis in the whole colony.

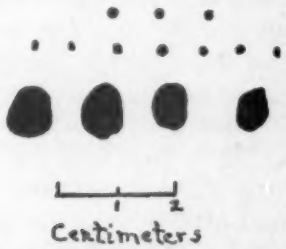
At the end of the 40-day experimental period the birds were sacrificed and their gonads removed. A testis of each bird used in the experiment was photographed *in toto* and then was sectioned and stained for histological examination.

RESULTS

The results of the experiment were clear-cut and consistent. No signs of gonadal hypertrophy or active spermatogenesis were found in any of the group of sound-stimulated birds nor in any of the control group which received only the normal amount of winter daylight.

In contrast, the birds of the control group which was given additional illumination were all well advanced in the sexual cycle. The testes were greatly enlarged, distinct lumina and mature sperm were observable in the seminiferous tubules. The usual seasonal secondary sex characters, such as darkening of the bill, were well marked.

These results are most clearly presented in Text-figure 1, which rep-



TEXT-FIGURE 1.—Testes of male English Sparrows. Top row, testes of normal controls; middle row, testes of sound-stimulated birds; bottom row, testes of light-stimulated birds.

resents tracings from the photographs of a testis taken from each of the birds used in the experiment. In the top row are shown the sizes of the testes of the birds which received only the normal winter ration of daylight (9.4 hours). These testes are typical for the normal male sparrow in the sexually quiescent condition of the late fall and winter. From histological sections of these testes, it was observed that the seminiferous tubules were at their minimum diameter, containing only spermatogonia.

The middle row of Text-figure 1 shows the testes of the sound-

stimulated birds. All are small and indistinguishable in size from those of normal birds in the sexually inactive state. The histological picture of the testes in this group was practically indistinguishable from that of the testes of the unstimulated control group. Seminiferous tubules were small and contained only spermatogonia. In not a single instance was there the slightest evidence of spermatogenesis.

The bottom row of Text-figure 1 shows the testes of the birds stimulated with 4.5 hours of light in addition to the normal winter ration. All are enlarged considerably and contain fully mature sperm, indicating that the conditions under which the colony was maintained did not in any way interfere with the reactivity of the pituitary to appropriate stimulation.

CONCLUSIONS

These results present clear evidence that, under the conditions of the present experiment, sound unlike light is ineffective in initiating seasonal sexual changes in the male sparrow. These results, therefore, are in direct conflict with the observations of Rowan (1938b) and Whitaker (1940) who originally suggested the possibility of the effectiveness of sound for sexual stimulation. It should be pointed out, however, that Whitaker's observations were made on the white-footed mouse and that the situation in this mammal may not be strictly comparable to that found in the sparrow.

The only environmental variable which has clearly been demonstrated to control the avian sexual cycle is light. The failure of temperature (Miyazaki, 1934; Scott and Payne, 1937; Suomalainen, 1937) and bodily activity (Bissonnette, 1932; Riley, 1940; Kendeigh, 1941) to influence sexual periodicity in the bird is well established. The experiments reported in the present paper would seem to eliminate sound as well, at least within the audible range used here.

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THE EUROPEAN STARLING IN GASPÉ

BY STANLEY C. BALL

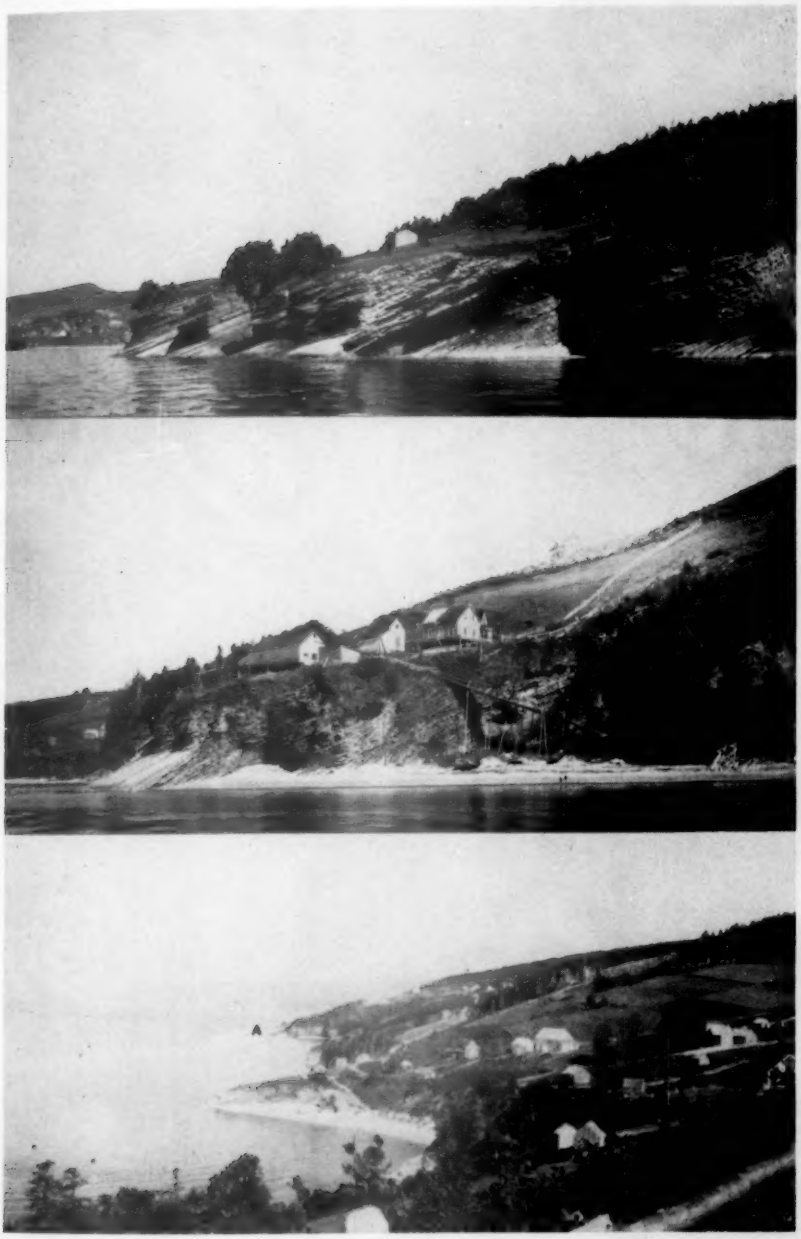
Plates 6, 7

IN its radiation from New York City where it was established in 1890, the European Starling (*Sturnus vulgaris* Linn.) was first recorded in Canada at Halifax, Nova Scotia, on December 1, 1915 (Tufts, 1926), and in southern Labrador in the spring of 1917 (Lewis, 192?: 513). For its early history in Ontario, the reader is referred to the excellent account by Dr. Harrison F. Lewis (1927). He has since followed the spread of this pioneer through Ontario, Quebec, and

Labrador (1930, 1931, 1933, 1934, 1935, 1941). On the southern shore of the Gaspé Peninsula he first recorded it at Oak Bay Mills on November 13, 1930, at Percé in 1932, and at Betchewun and Natashquan on the north shore of the St. Lawrence Gulf in 1933. To the westward he found a flock of seven at Moose Factory on the west shore of St. James Bay, Ontario, October 11, 1931. On September 22, 1941, he saw two Starlings at Albany, north of Moose Factory.

Not until 1940 was the Starling observed on the island of Anticosti (Lewis, 1941: 79). I have found no records from Newfoundland. This lack is consistent with the dispersal paths traced by Lewis (1927). The birds, having spread through Ontario, could be expected to push eastward north of the St. Lawrence through the suitable cleared land along the coast. Doubtless they have reached Gaspé by the southern St. Lawrence shore, as well as through New Brunswick.

In Grande Grève, on the north shore of the Bay of Gaspé, lives a bird observer, Mr. P. S. Hotton, who as a youth on the Isle of Jersey knew the Starling well. At the time of my first visit to Grande Grève, August 20–28, 1935, none of these birds had been seen, but upon my return in June, 1936, several pairs were found nesting. Mr. Hotton informed me that a few Starlings had appeared about his home for the first time in October, 1935. From Mr. Fred Richmond of Gaspé Basin it was learned that this species appeared there in 1932. A pair nested in the ceiling of his veranda, entering a lozenge-shaped hole left for ventilation. This Gaspé record of 1932 adds interest to Lewis's observation (1934: 88), May 12, 1932, of a flock of six at Percé, 41 miles southeast of Gaspé Basin, and visible from the hills behind Grande Grève. This may have been their first season in Percé as well as in Gaspé Basin. Their failure to reach Grande Grève until four years later, and to nest there until 1936, is the more remarkable in the light of another observation made by Lewis (1934: 89). On May 9, 1933, he saw three Starlings on Grindstone Island, one of the Magdalen Islands near the center of the Gulf of St. Lawrence. They must have crossed at least 55 miles of water to reach the Magdalens if they came from either Prince Edward or Cape Breton islands. From New Brunswick or Percé the distance is about 130 miles, somewhat less from Anticosti and Newfoundland on the north and east, respectively. I have found no records of Starlings on the latter, but on September 24, 1932, Lewis (1934: 89) saw a flock of 18 at Pownal, Queens County, Prince Edward Island. It may have comprised three or four families that had bred there in 1932. Several questions at once arise. Was this their first year on



(*Upper*) CLIFFS AT ST. AUGUSTINE (A IN LOWER FIGURE). (*Middle*) BOULET'S CLIFFS AND FISHING STAGE. (*Lower*) VIEW ALONG SHORE OF THE FORILLON; INDIAN COVE IN FOREGROUND.

the island? Did some or all of them winter there? Did some of them push on to the Magdalens the following spring?

Studies of the Starling in 1936 at Grande Grève and along the rest of the north shore of the bay revealed an interesting adaptation to local conditions. The birds' well-known predilection for cavities had led them to choose as nesting sites cavities in the shore cliffs in close proximity to Black Guillemots (*Cepphus g. grylle*). The limestone strata that compose the Forillon have been eroded by wave action in such a way as to leave along the Gaspé Bay shore a line of cliffs averaging about 20 feet in height (Plate 6). In some places, as at Grande Grève (Plate 7), they reach 40 feet, in others not more than ten feet. At various intervals these cliffs have been broken down so as to form gravelly beaches seldom accessible from above except by ladders (Plate 6, middle fig.). Of the entire five-mile shore from Little Gaspé to Cape Gaspé, perhaps three miles of cliffs exceed a height of ten feet above high-tide mark. But by no means all of this length is suitable for Starlings, partly because the erosion has not throughout led to the formation of cavities—mere niches are insufficient—and partly because of too great activity by fishermen around the many little beaches that dot the shore wherever wave action has piled a little gravel and cobble into a tiny cove large enough to haul a boat. Other parts of the cliffs, well provided with cavities and undisturbed, are probably unattractive because too far from good feeding grounds. At Cape Gaspé, and again east of Indian Cove, woodland extends for some distance up the slope above the cliffs. At the cape this is fast being cut off and the land placed under cultivation. It will be interesting to learn whether Starlings will nest in these terminal cliffs within the next few years as the environment improves.

William H. Hudson, in 'British Birds' (1895: 155), writes of the Starling: "a hole in a tree or rock, in a cliff or quarry, suits him very well." Probably in few localities in America has this bird become so consistent a cliff dweller as in Gaspé.

In 1936, three pairs occupied crevices at Grande Grève, two pairs at St. George's Cove, and two pairs near St. Augustine Church, half way down the Forillon (Plate 6, upper fig.), the most easterly point used that season. Some of these nests occupied holes not more than 12 feet above high-tide mark. During storms, spray dashed almost to the openings. Apparently the continuous noise of surf breaking against the rocks never bothered these sturdy birds. Nor was there any evident antagonism between Starlings and Guillemots. I hope

some year to reach Gaspé early enough in the spring to observe the selecting of nest sites. Perhaps some competition may then be detected. The likelihood is small, for there are numerous cracks and niches in these cliffs. Furthermore, the majority of the Guillemots, of which Grande Grève has about forty pairs, occupy holes in the lower half of the cliffs, while most of the Starlings select the higher ones.

The farmer-fishermen have left at the top of the cliffs a fringe of trees, mostly spruces, birches, and pin cherries (Plate 7). The Starlings perch frequently in the spruces above their nests, and the males occupy their 'singing trees' during many sunny hours. And upon these trees they often alight on their journeys with food for the nestlings.

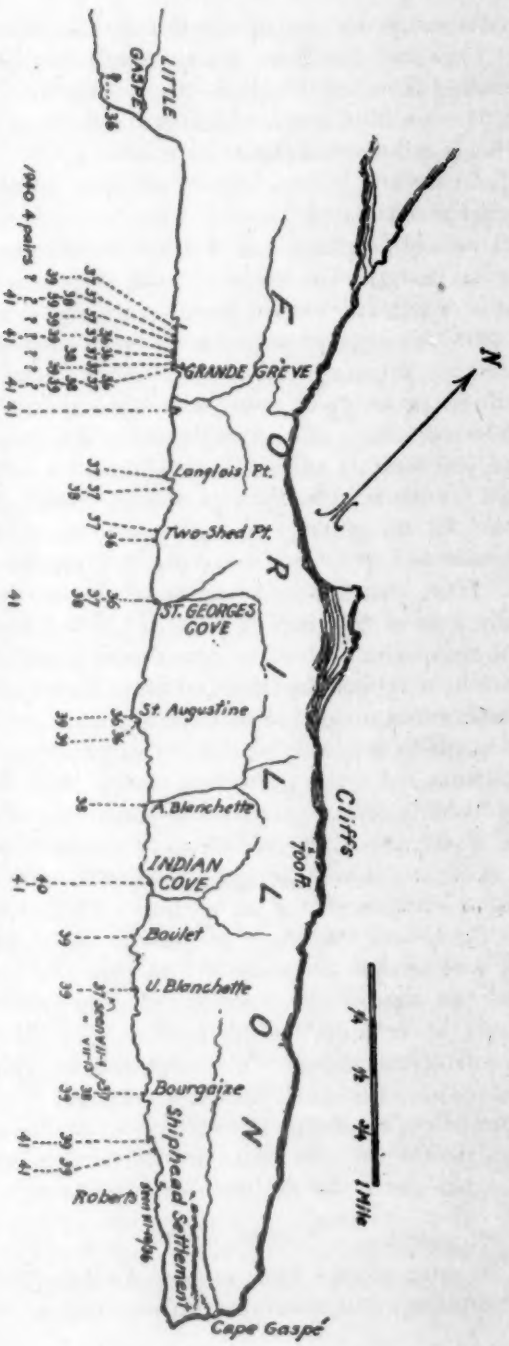
Feeding territories are not defended by these Starlings. On the steep, sloping fields, gardens, and pastures that extend upward from the shore cliffs (Plate 6, middle fig.) the adults obtain food wherever they can find it, sometimes within 50 feet of the nest, often from sources a quarter of a mile distant. Several pairs search amicably side by side. For days they may glean dipterous larvae from fish heads that have been scattered as fertilizer upon some field. At another time a particular house garden yields insect food, spiders, slugs, and perhaps earthworms. Again, a circumscribed area in a field of grass, so tall as to hide the birds completely, attracts the adults in their search for food to satisfy their young during the last week of nest life. The various pairs thence follow divergent lines to their respective cliff dwellings.

DISTRIBUTION

During the years 1936–1941, nesting Starlings have been found on both the northeast and southwest shores of Gaspé Bay, and for short distances up the three rivers that enter it, the Dartmouth, York, and St. John. But, true to their habits throughout their known range, none has been found far from man's cleared fields; none has entered the forests.

Curiously enough, the Starling population is greater along the Forillon and the rest of the north shore through Cap-aux-Os, Rosebridge, and St. Marjorique than along the southerly border of the Bay. Cultivation is the same on both sides; cliffs also are common to both. Perhaps, although no comparative temperature data are available, the southerly slope of the north-shore fields exerts an influence on the birds' choice.

Another variable is the nature of the cliffs. Whereas sandstone enters into the constitution of cliffs west of Little Gaspé, at Cap-aux-Os, St. Marjorique, and along a part of the south shore, those



TEXT-FIGURE 1.—Location of Starling nests on the Forillon, 1936–1941.

of Grand Grève and the rest of the Forillon consist wholly of hard limestone. This rock has more fractures and cavities than the red sandstone, and it is on the Forillon that practically all Starlings nest in the cliffs. It should be emphasized that, conifers prevailing, hollow trees are almost wholly lacking in proximity to the Bay. An occasional cavity in *Betula, Sorbus,* and a rare *Acer* may be found in the forests, beyond reach of Starlings.

In 1941, a pair of Starlings nested in the broken roof of a building that almost overhangs the cliff at Grande Grève. This constitutes the first use of a building on the Forillon during their first six years there. In 1943, a pair occupied the chimney of a vacant house at Grande Grève. Farther up the Bay shore, Starlings as a rule chose buildings, probably because few suitable rock crevices occur in such sandstone cliffs as face the Bay at a few points. Indeed, at Little Gaspé just west of the Forillon's base, the only cliff is a low one of Gaspé sandstone. As John M. Clarke (1908) has pointed out in his account of the geology and paleontology of the region, this is the most easterly exposure of red sandstone on the north shore of Gaspé Bay. It is, therefore, no matter of chance that in 1936 the first and only pair of Starlings to nest in Little Gaspé (Text-fig. 1) occupied a hole in the roof of an abandoned house instead of in a cliff, as did their neighbors at Grande Grève, three-quarters of a mile to the east where limestone cavities were available.

It is noteworthy that in 1936, their first breeding season on the Forillon, Starlings reached a point half a mile from the tip; one was reported on Wilson Roberts's barn on June 10 (Text-fig. 1). But this pioneer apparently withdrew, for none nested beyond St. Augustine, about half way down the little peninsula. Here two families were successful. Another bred in a short cliff above the beach at St. George's Cove, and two more within 50 meters of each other a quarter of a mile farther westward in limestone crevices at Two-Shed Point. Near the base of the Forillon, Grande Grève attracted the largest number, three pairs, in this first season. Its popularity has continued, probably for the three following reasons. First, the nesting holes are numerous. Secondly, the largest human population resides here, thus providing an abundance of food in an acceptable habitat. Thirdly, Grande Grève is the first attractive area which the birds encounter as they enter the Forillon from the west.

NESTING DATES

Although in some years I have reached Grande Grève as early as June 14, the Starlings had always begun incubation. Until hatching

time the adults are infrequently seen. This seems extraordinary, in view of the males' noisiness on their territories in New England. But no attempt has been made methodically to record the adults' activities until they have begun feeding the nestlings. They are then conspicuous enough, so that a fairly complete picture of their behavior can be obtained without neglecting other work.

So quiet were the Starlings following my arrival on June 14, 1941, that not one was seen during the first week. Then on the 21st, three pairs suddenly appeared on the roof of a fisherman's house close to the cod-drying 'flakes' on the beach. Four days later, these six birds were busily carrying food from a neighbor's garden to their cliff holes. On the 26th, a fourth pair began feeding young in the roof of a storehouse at the other end of the beach. They were still carrying food into this hole on July 11. No juveniles were noticed until the 16th when one family was perched in a spruce at the top of the Grande Grève cliff. Eleven young reached a tree far up the slope on the 18th, and 22 juveniles and adults were seen there on the 23rd. Four adults and fourteen young were counted on the 27th. Later in the day they left Grande Grève for the season, flying compactly up the Bay toward Little Gaspé.

The 1940 nestings may have been delayed a few days, for upon my belated arrival, July 26, the picture all along the Forillon was of family groups not yet united into the large summer flock. Even as late as August 21, two adults with five juveniles were active at Grande Grève.

The earliest date upon which young are known to have emerged from their cliff dwellings is July 2 (1938, 1941). In 1937 at Grande Grève, and 1939 at Shiphead, the event took place a day later. It is interesting that in 1936, the first year Starlings nested on the Forillon, the earliest emergence of juveniles occurred ten days later, July 13. That it should fall on so nearly the same date in four years out of six is noteworthy. In 1940, I was told that four pairs had nested in the Grande Grève cliffs. But the date of first emergence of young was not recorded. Judging from the presence of a family group at Indian Cove, and another still frequenting Grande Grève, the 1940 season had not differed appreciably as to dates of nesting and dispersal.

No evidence has been obtained that any pair of Starlings in Gaspé has attempted a second nesting in the same season. Nor would second broods be expected. Even in Ohio, where the favorable season is longer, Hicks (1935: 61), after careful banding studies, concludes that 95 per cent of the birds nest successfully but once each year.

BEHAVIOR OF ADULTS AT CLIFF DWELLINGS

Observations from on shore, the fields above it, and from a boat off the shore have established the behavior of adult Starlings about their nests at Grande Grève. I have not reached Gaspé in time to witness nest-building, but the only nest accessible without special equipment was of the usual construction, made up of grasses, flexible strips of bark, leaves, seaweed, and a few feathers from nearby barnyards. This nest was on the floor of a crevice about eight inches wide and seven feet deep, that extended downward almost perpendicularly from the steep slope above (Plate 7, right 5). Shortly after noon, the sun for a brief period sufficiently illuminated the crevice from the cliff face so that the nest could be discerned. Photography was unsuccessful.

From the boat, seven nesting sites in 1937 could be watched at once. It appeared that the members of each pair relieved each other at incubating. Before descending, a bird usually spent some time on its favorite tree at the cliff brink, preening and calling. It then glided down, usually to a point somewhat below the hole, and ascended to the entrance. Without delay it would enter, and almost immediately, with or without comment, a bird hastily would emerge, drop a fecal sac, and ascend to the territorial spruce. This was judged to be the relieved mate, for there was no evidence that food was carried by the arriving bird. Sometimes the emerging bird, without alighting, flew directly to one of its feeding grounds, usually nearby, but not infrequently to a garden a quarter of a mile distant. To reach it the Starling had to pass over, or around, an elevated point of land. I made no attempt to determine the length of individual incubation periods and the feeding intervals.

Even during afternoons when the sun warmed the cliffs, the adults seldom spent a full minute exposed to view at their nesting sites. This is remarkable, especially in the two instances where convenient roosting places existed. Apparently the urge of the returning bird to incubate and that of its relieved mate to exercise and feed were strong enough to preclude any basking on the sunny doorstone.

Hatching speeded the activities of the parents. Seldom thereafter were they to be seen resting on the territorial tree, but shuttling rapidly back and forth between feeding ground and nest hole. Even the momentary stop at their tree was usually omitted; from field, garden, or the 'fish-flakes' where cod was drying, as soon as a mouthful of food could be procured each bird flew as directly as possible to its nest. If the source were at some distance along the shore, the bird

consistently made most of its flight over the water, paralleling the cliffs, sometimes only six feet from them, again fifty feet seaward, now at the level of the cliff top, and again barely missing the heads of the Guillemots on the water's surface.

Rarely was a food-laden Starling seen to take a full stride along the entrance sill; nearly always its feet dropped only as it disappeared within the hole. After three to ten seconds it would burst as suddenly forth, frequently to retrace its route to the last visited feeding ground. But more than once I saw evidence that the bird either recalled another previously used source or was attracted, perhaps by the sight of another bird, to a new feeding area.

Behavior of Young

My first visual evidence of the young was their appearance at the mouths of their holes. One instance may be cited. In 1937, nest no. 7 at Grande Grève was hidden behind a piece of rock (Text-fig. 2, *a*) but was provided with a sill extending from *b* to *c*.

On July 8, at 6:30 A. M., two young were seen to emerge from behind this block. First one and then the other approached the edge at *b*. After a few moments both withdrew. At noon the same day, I was fortunate in witnessing what I believe to have been the first flight of a short-tailed juvenile from this nest. The boat was hardly anchored when, at 12:20, the bird quickly walked out from behind *a* to the edge at *b*. After standing a moment, calling twice, it hesitantly sidled along the tiny ledge to *c*, glanced downward, then upward fixedly for about five seconds. Without perceptible initial drop toward the water, it rose on rapidly beating wings to a fallen tree-top that projected over the edge of the cliff twelve feet above. After resting a few moments, the youngster hopped from branch to branch until hidden from view by the bushes. The probability that practice flights preceded this ascent seem ruled out by the environment.

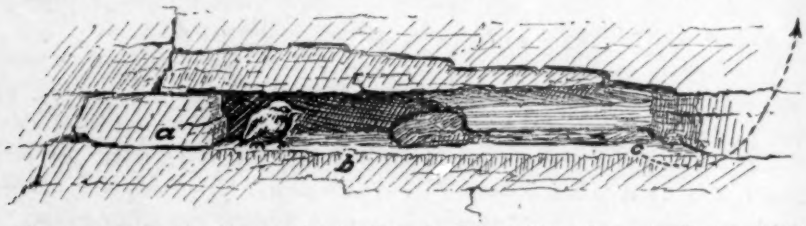
At 12:42, two more young appeared in the vestibule of their home, but had attempted no flight before my departure at 1:00. Had they witnessed their comrade's successful venture, I might have seen the entire brood launched upward. That they, too, attained the cliff top was apparent at 4:20 when the parents were feeding three young in their favorite spruce nearby.

This brood was the second to emerge. On my way down to the boat at 6:15 A. M., I noted two immature Starlings on a spruce at the top of the cliff above nest no. 1 (Text-fig. 1). That they had emerged from this nest was confirmed by total lack of activity at the hole during the day. By July 13, the other five had joined them, and

the combined flock roosted chiefly in the evergreens along the cliff top. During the day they made frequent sallies to feeding grounds or attractive perching places. One such favorite was a dead birch beside a fence far up the slope from their cliff colony. As many as 15 young, frequently accompanied by some of the adults, occasionally visited the coulee behind Grande Grève. That the group was no larger was due to predators (see p. 91).

BEHAVIOR OF THE MIXED FLOCK

At least eleven adults and young were seen together at St. George's Cove on July 13, 1936. The three Grande Grève broods left their nests at about the same time. From July 20 until August 26 a mixed flock of 27 adults and young frequented the countryside between St. George's Cove and Grande Grève. An increment of six—probably the family from Little Gaspé—then brought the total to 33. Appar-



TEXT-FIGURE 2.—Nesting crevice in Grande Grève cliff. Arrow indicates initial flight of juvenile to tree at top of cliff.

ently all left for the west on that day, for none were present on the 27th. But five of them were back on their favorite cliff-spruces on the 28th, and the group had grown to nine the following day. Of course, the identity of these individuals could only be surmised; some may have left, to be replaced by others. None was seen on August 30, my last day in Gaspé.

The 1937 flock remained at Grande Grève until July 22. Doubtless, like all passerine migrants, they then proceeded northwestward up the Bay, for two days later a flock of about 50 fed in the fields at Cap-aux-Os, six miles distant. During the late summer as many as 500 Starlings have been seen together with 300 grackles near St. Marjorique, eleven miles farther up the Bay, where rolling fields can support them. Most of these birds are believed to have come through the mountains from the north shore of the Gaspé Peninsula.

On the 27th, a single adult called and sang for twenty minutes in a spruce grove on top of the ridge, and nine visited our dooryard on August 3. Not another Starling was seen on the Forillon until August

24 when 16 appeared on the upper fields behind Grande Grève. They were feeding westward at 9:30 A. M. along the fences. Only one adult was noted. The immature birds, though considerably spotted, were still brown. Again on September 13, the day of my departure, two Starlings and a flicker perched in a birch tree beside a house.

On November 1, a correspondent at Grande Grève wrote that since October 12, when 23 were seen during a snowstorm, Starlings had been seen almost daily.

FLUCTUATION IN POPULATION AND LOCAL RANGE

It was stated above that in their first breeding season, 1936, seven pairs of Starlings distributed their nests along the basal half of the Forillon (Text-fig. 1). The easternmost sites were in the cliffs below St. Augustine's church where two pairs reared broods. Of the others, two pairs chose short and comparatively low cliffs about a quarter-mile apart at St. George's Cove, while three inhabited the longer, higher ones at Grande Grève. The season on the whole was successful. Every one of the 14 adults survived, and each of the three Grande Grève pairs brought out four young, all of which lived to migrate. At St. George's Cove, the two broods numbered four and three young, and at St. Augustine, four and two. The season's increase on the Forillon was 25, and the population total in August was 39, or nearly three times the number that invaded the little peninsula in the spring.

Of these, the largest number seen together at one time was 33, an accumulation of the Grande Grève population of 18 birds (six adults and 12 young), 11 (four adults and seven young) that had appeared two days before, and six new arrivals (one adult and five young). Their behavior was significant. All were discovered in the early forenoon of August 26, perching quietly upon two partly dead birch trees far up the slope behind one of the Grande Grève houses. Presently all flew down toward the shore, familiar to 18 members of the group as their home, and to 11 others through two days' experience. Without alighting with their mates on the spruces at the edge of the shore cliff, six birds detached themselves from the flock and returned to the trees above the house. One may imagine that they constituted a family group, the increment of the morning from farther down the Forillon.

On the following day none was seen, but on the 28th, five were perched on the favorite spruce above the cliffs, and on the 29th, nine were observed on telephone wires along the road. Later in the day, a group of the same number fed for an hour in a newly-mown field at the west end of Grande Grève. These were the last seen on the

Forillon before my departure a few days later. Doubtless, they had passed on up the shore to augment the flock seen near the head of the Bay.

In a letter written on October 1, 1936, Mr. Franklin Gavey, whom I asked to watch for Starlings, reported as follows for Grande Grève and Little Gaspé during the previous month:

Date	*Starlings*	*Date*	*Starlings*	*Date*	*Starlings*
Sept. 1	9	Sept. 11	9	Sept. 21	6
2	3	12	2	22	9
3	15	13	0†	23	9
4	0†	14	24*	24	0†
5	3	15	9	25	18
6	17*	16	2	26	9
7	5	17	0†	27	16*
8	3	18	0†	28	2
9	8	19	4	29	4
10	9	20	2	30	3

* In Little Gaspé
† Stormy

It is evident from this record that some movement back and forth occurs, for the numbers, disregarding stormy days, varied from two to 24. Mr. Gavey made similar observations in the fall of 1937 and in 1938. Remembering that it was during the autumn of 1935 that the first Starlings reached the Forillon, it may safely be concluded that during the period of greatest movement, these birds, like other passerines, frequently passed southeastward into the peninsula and back again to the northwestward. I have witnessed similar behavior in 1939, 1940, and 1941.

In view of the successful initial breeding season, it is not surprising that the number of pairs found nesting in 1937 rose to eleven. As shown in Text-figure 1, Grande Grève again attracted the larger number; seven pairs occupied cliff cavities. Rather surprising was, not alone the failure of these enterprising birds to extend their range farther toward the tip of the Forillon, but even a withdrawal from St. Augustine. The easternmost nest was at St. George's Cove in the same cliff crevice that was occupied in 1936. The next brood to the westward was raised, not in the identical cavity on Two-Shed Point used during the first season, but in another 100 meters up the shore.

Two entirely new holes were chosen near the Langlois farm between Grande Grève and St. George's Cove. Here fish refuse in considerable quantity was available on the beach, and one of the best gardens lay on the steep slope just above. If it be imagined that these two pairs represented the 1936 families at St. Augustine, the population thus far considered may be regarded as the same as that which opened the 1936 season.

The Grande Grève cliffs, however, supported four new nests. Three occupied holes somewhat farther westward; the fourth was among the three which had been used previously.

Only twice during 1937 were Starlings seen east of St. George's Cove, one at Shiphead on July 13, the other on July 4 at Blanchette's landing. Although neither of these established a nest in 1937, the fact that they ranged so far eastward while others were nesting suggests either that they were unmated birds in pioneering rôles, or members of pairs established farther west, and were ranging farther than usual in search of food. It was interesting to find a nest at one of these locations the following season, and at both in 1939.

Owing chiefly to predation by Crows (*Corvus b. brachyrhynchos*), the 1937 breeding season was less fortunate for the Starlings. On three occasions, Crows were observed eating young Starlings, and I saw one Crow enter a nesting cavity in the Grande Grève cliff, emerge with a struggling fledgling, and fly up into a spruce tree where the prey was torn to pieces and devoured. For weeks, eight or ten Crows frequented the trees bordering this cliff. The adult Starlings were unable to drive them away. As a result, not over 15 young out of a reasonable expectation of 28 from seven nests survived to migrate.

Another predator suspected of taking an occasional Starling was a Duck Hawk that dwelt on the Bon Ami cliffs on the north side of the Forillon. More than once it took immature Black Guillemots from the vicinity of their nests in the Grande Grève cliffs.

It would, perhaps, be unwise to suggest that the Crow depredations of 1937 were remembered by Starlings in choosing the nesting cavities the following spring. It is a fact, however, that the holes with large entrances have not harbored broods since 1937, while as many as four of the crow-proof crevices have been used consistently. At the same time it should be stated that Crows were more numerous in July and early August, 1937, than in subsequent years, at least through 1941. By the time of the great fall gatherings of Crows in late August, September, and October, the immature Starlings had left or learned to protect themselves. Indeed, they not infrequently have been seen roosting amicably on the same trees.

The greatest flock of Starlings observed in August, 1937, numbered 16. This included only one adult. The others were regarded as an aggregation of the 15 young that had previously been observed with their parents as they fed in the fields above their respective nest holes. Absence of the other 21 adults on this and the following days suggested that they had already migrated up the Bay shore.

In the spring of 1938, only seven pairs of Starlings nested on the Forillon. As shown in Text-figure 1, only three of the nest holes at Grande Grève were occupied. One pair settled at Langlois Point, and one in the usual crevice at St. George's Cove. This year brought an advance down the peninsula, with a nesting below Alex Blanchette's and another at the western end of Shiphead Settlement in a cliff hole a mile from the tip. The first of these yielded five young, seen with their parents July 15 on a spruce above the cliffs. This family group was joined next day by the pair and their three young that had occupied the Shiphead site.

Twenty-two Starlings seen together July 7 at Grande Grève, and 21 on July 23, constituted the largest groups recorded for the 1938 season on the Forillon. They left the locality on the 29th. No others appeared there until August 9, when a flock of nine passed eastward overhead. But these and other groups numbering from eight to 20 are not to be considered as parts of the 1938 breeding population on the Forillon but rather as autumn migrants.

Referring again to Text-figure 1, it appears that in 1939 thirteen pairs of Starlings nested on the Forillon, two more families than in 1937. The Grande Grève and St. Augustine cliffs were again well occupied. For some reason, no birds settled at Langlois Point, Two-Shed Point, nor St. George's Cove. But four new sites, all in cliffs, were established far down the peninsula. As usual they were chosen in proximity to the cod-dressing and drying stations associated with fishermen's homes, and with their barnyards and gardens. The two nestings recorded at the eastern end of Shiphead settlement extended the local breeding range to within three-fourths of a mile from Cape Gaspé.

Although holes and food are available on the premises of the two easternmost farms, 100 meters from Cape Gaspé, this environment has not as yet proved sufficiently attractive. Curiously enough, on about June 10, 1936, a "short-tailed black bird" perched for half an hour on the shed gable at the home of Wilson Roberts, 200 meters east of the 1939 nests at Shiphead. I have neither seen nor heard of a Starling nearer to Cape Gaspé.

Several other cliff cavities along the Forillon have been occupied during one or more seasons. These are indicated on the map.

The total population has decreased since the peak year, 1939, when 13 nests were occupied, and 33 juveniles and several adults had gathered on July 15 at a field newly fertilized with fish heads. It may be that the species will not increase greatly in Gaspé County as a

whole. That it will remain less abundant on the Forillon than elsewhere in the region is to be expected, for along the south shore of the St. Lawrence River lie greater cultivated areas; similarly on the Bay of Chaleur. Even the lands about the head of Gaspé Bay and along the estuaries of its tributaries, the Dartmouth, York, and St. John rivers, constitute better feeding grounds than the steep, restricted fields of the Forillon. The same is true of much of the south shore of the Bay, and particularly of the broader farm lands along the eastern end of the Gaspé Peninsula.

At any rate, according to the accounts of fishermen when I arrived on July 26, the 1940 population was again small. Apparently four pairs had nested at Grande Grève, but none near Shiphead. The only new station was at Indian Cove, where a family was still present on July 31.

In 1941, three pairs nested in the Grande Grève cliffs, and another, as noted above, in a hole beneath the eaves of a shed overhanging the cliff. The St. George's Cove site, the one established in 1940 at Indian Cove, and the two easternmost at Shiphead, first used in 1939, were again occupied. Twenty-two birds seen at Grande Grève on July 23 made up the largest group seen in 1941.

Judging from letters received from fishermen at Shiphead and St. George's Cove, in addition to those of Mr. Hotton, the storekeeper at Grande Grève, Starlings decreased somewhat during 1942. In the spring and early summer, Hotton saw a few. After their departure as usual in August he saw none until October 11, when 12 perched in a row of spruces beside his home. At Gaspé Basin, Mr. Richmond also noticed very few in spring, none in autumn.

The spring of 1943, writes Wilson Bourgaize, brought several Starlings to his cove and dooryard at the western end of Shiphead settlement. Doubtless some of them again nested in his cliff, and others along the Forillon east of Grande Grève, for in January, 1944, Mr. Hotton wrote that "one made her nest in the north chimney of the red house," and that quite a flock, 50 or more, were around all summer and fall of 1943. This would indicate, as he judged, a few more than in previous years.

On the south shore of Gaspé Bay, opportunities for observation have been less frequent. The population is not far different from that of the Forillon. In driving along the roads with frequent stops, the greatest gatherings seen numbered 11 at Seal Cove opposite Grande Grève, October 8, 1940, and about 25 at Sandy Beach just east of Gaspé Basin, September 25, 1941. These may have been migrants.

Although no attempt was made to locate nests, adults have been seen near several small fishing villages under conditions indicating that they were breeding.

Evidence was obtained on the wider and more level farm lands bordering the estuaries of the three rivers tributary to Gaspé Bay that Starlings were more numerous there than on the Forillon or the south shore. None was seen along these streams above the last farms, nor did inquiry among the lumbermen bring information of Starlings seen at their large camps where food in considerable quantity was available about the stables and garbage dumps.

Along the south shore of the St. Lawrence from Cap-des-Rosiers to St. Anne-des-Monts, several summer trips gave the impression that Starlings are not increasing more rapidly there than about Gaspé Bay.

MIGRATION

To the rapidly accumulating evidence of an autumnal southward migration of Starlings from the more northerly portions of their range (Thomas 1934: 120), a few observations in Gaspé may be added. Although a few, perhaps most of the pioneers, passed the winter there, the great majority now move out. I have cited the autumn flocks associated with grackles in the fields about St. Marjorique. It is my belief that many of these come down through the Fox River 'portage' from the open country along the south shore of the St. Lawrence. It is quite possible that some of these Starlings come from some distance westward, for it is certainly true that many warblers, nuthatches, and sparrows pass eastward through Fame Point, Grande Étang, Griffon Cove, and Cap-des-Rosiers to the Forillon. Thence they move westward up the north shore of Gaspé Bay to the estuary of the Dartmouth River.

Only once on the Forillon, August 15, 1938, was a group of Starlings observed over the forest. About 20 birds that had been feeding about the fish-houses at Grande Grève suddenly rose, flew a short distance down the shore, circled inland behind the houses, and passed swiftly northwest up the coulee to disappear over the wooded Mt. St. Alban beyond the base of the Forillon.

After crossing the Dartmouth River at the head of the northwest arm of the Bay, these flocks of Starlings pass either through the portage from L'Anse-aux-Cousins to the fields along the York River estuary, or through the village of Gaspé Basin. Messrs. Fred and George Richmond report hundreds of Starlings and grackles feeding along the slopes above the town, and each year observe their departure "straight for the Forks of the St. Jean," that is, in a west-southwesterly direction. The significance of this phrase will presently become evident.

Such movement as I have seen on the south shore of the Bay indicates that the Starlings reared in that section may also move westward up the St. Jean. Small groups have been seen working up the north shore of the St. John estuary. Even more interesting is the northwestward progress of two small groups along the railroad at Seal Cove and Douglastown east of the river's mouth. That the movement of *Quiscalus,* especially during these early years of the Starlings' presence in Gaspé, should determine their southward path would not be surprising. For such mixed flocks are common in southern New England and elsewhere in autumn. The departure of the grackles has long been an annual source of wonder to the Richmond brothers. Although they have not kept written records, they insist that the great departure occurs about July 20. But they agree with me that considerable numbers pass through Gaspé much later in the season.

Evidence is gathering that warblers, thrushes, and robins, at least, pass westward in autumn up the valleys of the York and St. Jean. Future study may confirm the conjecture that these migrants cross the divides into the valleys of the southward-trending Bonaventure and Cascapedia rivers. This evidence will be presented in another paper now in preparation.

Dr. Lewis's records of Starlings on Prince Edward and the Magdalen Islands (1933) emphasize the independence of the species. Where an overland route is offered it appears to avoid the water, as around Gaspé Bay. But in order to reach Prince Edward it had to cross Northumberland Strait, a wider body.

Recently the Shetland race of Starlings has invaded northeastern Greenland (Bird and Bird, 1941). Whether their route included the Färoes and Iceland, or Norway and Spitzbergen, wide stretches of sea were crossed.

Wintering of Starlings in Gaspé

Following their first appearance in 1931, a few Starlings passed the winter in the vicinity of Gaspé Basin, coming occasionally for food to the dooryards of Fred J. Richmond and his neighbor. In subsequent winters he has seen small groups now and then. Four birds visited his barnyard throughout the winter of 1940–41. Six more appeared in late winter, remaining until the grackles arrived in March. He reported about 20 in his yard on December 20, 1943. Again, January 8, 1944, an extraordinarily large "flock of about 50 were perched on two crab-apple trees near my house where I fed them last winter and spring. They appeared busy eating either buds or the seeds out of crab-apples, as I left the greater part on the trees

last autumn. On the 11th the flock was back again." The numbers afterward fell off gradually to about 20 that continued daily to feed on grain provided throughout the winter. They were still present on April 14. Although four robins and a large flock of grackles arrived that morning, borne by a strong southeasterly storm, no spring addition to the Starling population had been made.

Writing on April 23, 1937, Franklin Gavey reported four Starlings at Grande Grève on the 15th, ten on the 16th, and some "heard every morning" thereafter. A few grackles also had arrived. On March 14, 1938, he wrote that "the starlings have been here all winter till about a month ago, when they disappeared. We fed them crumbs and scrap." Similar reports in succeeding winters, the last one concerning a flock of 50 or more that appeared in Grande Grève about Christmas time, 1943, after a six-weeks absence of Starlings, taken with Richmond's experience in Gaspé Basin, make it plain that a number pass each winter about Gaspé Bay, searching here and there for food. It is not unlikely that the 50 birds observed in Grande Grève in December, 1943, were those reported the following month by Richmond in Gaspé Basin, 12 miles westward.

The majority, however, migrate presumably southward. In other words, the population changes from season to season much as in New England.

SUMMARY

1. The first appearance in 1935, and subsequent history of the European Starling on the Forillon in Gaspé, Quebec, is recorded.

2. Adapting themselves to local conditions, the Starlings along the Forillon nest chiefly in cavities in the limestone shore cliffs.

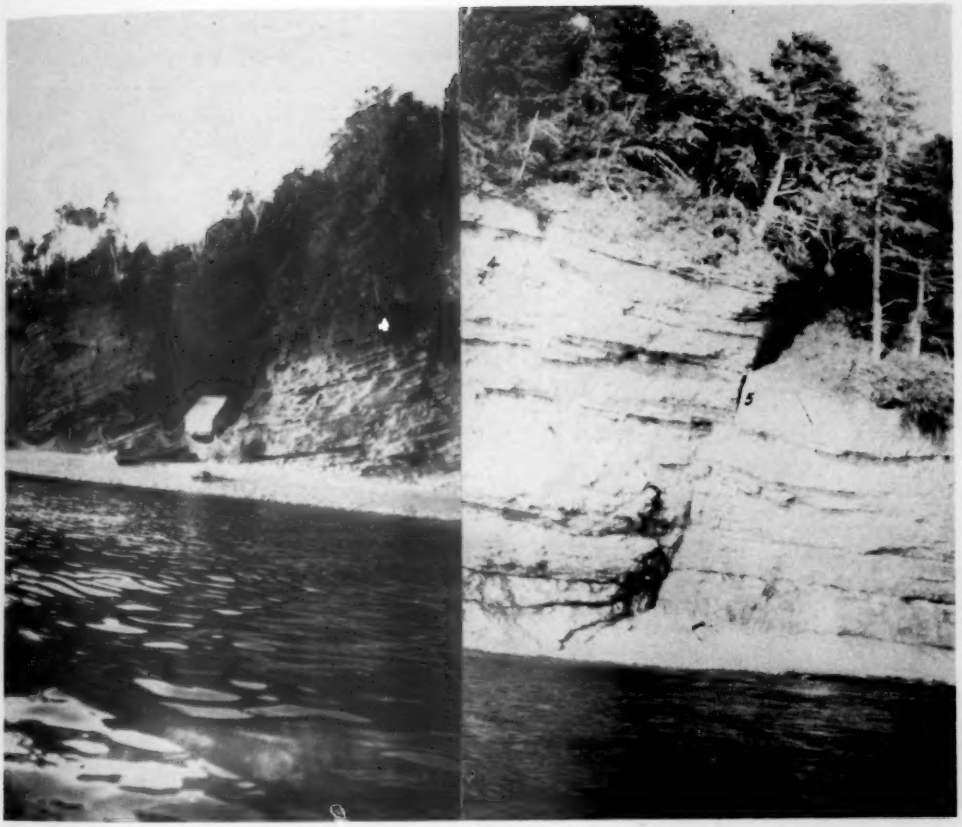
3. July 2 is the earliest known date on which young have left nests in the Gaspé region. In 1938 and 1941, first emergence occurred on July 2; in 1937 and 1939, on July 3.

4. In its initial attempt, a young bird was seen to fly 12 feet upward to a tree at the top of the cliff.

5. Although plenty of nest holes dot the southern cliffs of the Forillon, the Starling has not increased rapidly there. Crows constituted an effective control in 1937, destroying a number of young. In 1938 the Starlings chose holes less accessible to Crows.

6. Distribution of nests is correlated with favorable feeding grounds.

7. The extension of the nesting range from the base toward the tip of the Forillon was traced. No nests were built along the terminal three-quarters of a mile of shore, nor in the northern cliffs, 200 to 700 feet high, which present a sheer drop into the Gulf of St. Lawrence.



(*Left*) SMITH'S STAGE AT GRANDE GRÈVE; NEST SITES NOS. 1 AND 2. (*Right*) GRANDE GRÈVE; NEST SITES NOS. 4 AND 5.

8. The greatest number of nests observed on the Forillon was 13 in 1939. The largest fall flock seen by the author comprised 33 birds, also in 1939. Judging from letters received from residents, the population in 1943 may have been greater.

9. Although most of the Starlings migrate, a few have passed each winter in Gaspé. The number increased to about 50 in 1943–44.

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DO BIRDS CROSS THE GULF OF MEXICO IN SPRING?

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THE THEORY

IT is almost universally believed that, in spring, many birds migrate northward directly across the full width of the Gulf of Mexico. They are said to take off from Yucatan and the Campeche Bay region in the evening, with favorable weather, and reach the Gulf Coast of the United States the next morning.

Though this theory of trans-Gulf migration is so generally accepted, I can find no modern writer giving actual evidence in support of it. Apparently all evidence that exists was assembled one or two generations ago; and the theory itself was publicized by the late Wells W. Cooke early in the present century. Since Cooke's time every writer that I can find discussing bird migration in North America accepts the theory at face value, and inquires no further.

One of the reasons, perhaps, why ornithologists have ignored the problem is that peculiarity of logic which makes absolute disproof of most theories almost impossible. Thus, nobody yet has actually disproved the theory that mother snakes swallow their young to protect them from enemies; or that small birds hitch-hike on the backs of larger birds during migration; or that the interior of the moon is made of green cheese. We cannot disprove these theories; all that we can do is to show how evidence for them is lacking, or how the preponderance of evidence supports another theory.

The evidence that Cooke marshalled to support the trans-Gulf theory was of three kinds: (1) that migrating birds have actually been seen crossing the Gulf; (2) that species unknown or uncommon in spring on the coasts of Texas and of Florida may appear in great numbers in the lower Mississippi Valley, or along the Louisiana coast; and (3) that simultaneous arrival dates of many species all along the Gulf Coast indicate an overnight, trans-Gulf flight.

Let us examine this evidence in the order mentioned.

BIRDS ON THE GULF OF MEXICO

One of the pillars upon which Cooke (1904: 25) leaned heavily for his theory of trans-Gulf migration was M. A. Frazer's paper (1881) recording the appearance of several species of migratory birds "seen at noon April 22, 1881, 30 miles off the coast of Louisiana, striving to reach the shore against a severe norther." As a matter of fact, Frazar's date is April 2, 1881; and he saw the birds about an hour after noon.

Frazar's paper is worth studying carefully. He writes: "At about noon of that day the wind suddenly changed from east to north, and within an hour it was blowing a gale; we were now about thirty miles south of the mouths of the Mississippi River . . . within an hour after the storm broke [birds] began to appear, and in a very short time birds of various species were to be seen in all directions, singly and in small flocks, and all flying towards the Mississippi River."

Frazar gives a list of 23 species which he recognized in the storm. Among these birds were "a few" Towhees. This species, however, does not winter south of the United States. We must conclude, therefore, that it was blown *southward* from the mainland; it was not migrating across the Gulf. Furthermore, several other species seen (Myrtle Warbler, Maryland Yellow-throat, Phoebe, Pigeon Hawk, Mourning Dove, Turnstone) are common winter residents of the Gulf Coast region. Two species (Cliff Swallow and Pigeon Hawk) are known to migrate by land rather than by water; and all the other species Frazar mentions are common spring migrants through Florida. On the whole, therefore, it would seem quite logical to believe that the birds, instead of being met by the norther on a trans-Gulf flight, had been migrating along the Gulf Coast (perhaps with the east wind that had been blowing), and had been blown *southward* into the Gulf.

This interpretation is consistent with the observations recorded by W. T. Helmuth (1920) on making a trip by water from Sabine Pass, Texas, to Tampa, Florida. On March 29, 1918, Helmuth, then aboard ship, writes: "A 'norther' with terrific wind and rain . . . 125 miles from land." On this day three Great Blue Herons, a Belted Kingfisher, several Tree Swallows, Robins, Redstarts, and Myrtle, Parula, and Black-throated Blue Warblers came aboard the ship.

This record, too, deserves careful scrutiny. The first point of interest is the fact that the ship must have sailed straight from Sabine Pass to Tampa, for it was "Anchored off Sabine Pass" March 28, presumably left there late on the 28th, or on the 29th, and reached the coast of Florida in the early afternoon of March 31. It could not have made the trip so quickly if it had not gone directly. Accordingly, at some time on March 29 the ship may have been 125 miles from Sabine Pass, but it must have been relatively near the Louisiana coast. Secondly, five of the eight species mentioned are abundant winter residents of Louisiana; and the Robins could not possibly have come from south of the Gulf. Lastly, a "terrific" north wind was blowing. The only logical explanation of these facts is that the birds were blown *southward* from the coast. They were not making a trans-Gulf migration.

On March 30, on this same trip, Helmuth reports: "Very heavy weather with violent squalls, wind varying in direction." At this time the ship was probably not far off the mouth of the Mississippi. A Henslow's Sparrow came aboard, and five Louisiana Herons were seen. The sparrow does not occur south of the United States, and therefore was certainly blown out from the mainland; and the Louisiana Herons doubtless came from the same place, since the species is not known to migrate from regions south of us to Louisiana.

The morning of March 31, when the ship was about 90 miles off the entrance of Tampa Bay, Myrtle, Parula, Black and White, and Prothonotary Warblers came aboard and spent the morning. All these are birds regularly and abundantly present in Florida at that time, and could easily have been blown from the peninsula, or off their normal coastwise migration route, by the "violent squalls" of the preceding day. The fact that they stayed aboard the ship so long indicates that they were tired or lost.

Birds appear frequently on ships plying about northwestern Cuba, the Bahamas, the Florida Keys, and the west coast of Florida. It seems, therefore, that if birds really did migrate across the Gulf itself, they would have appeared at some time on ships plying across the middle of the Gulf. But I can find no record of such appearances. All seeming records (like Helmuth's) when broken down and analyzed critically, reveal only the well-known fact that adverse winds may blow migrating birds to sea.

In the spring of 1939, a Bureau of Fisheries boat engaged in shrimp research spent several weeks at the height of the spring migration period at different positions 20 to 100 miles off the Louisiana and Texas coasts. My friend, Mr. Albert W. Collier, who was on the boat, reports to me that, when the boat was fairly close to land, a Sparrow Hawk and one or two other small birds came aboard while northers were blowing; furthermore, when the boat was 20 to 30 miles east of Corpus Christi, Texas, a northward migration of Barn Swallows passed during several days of fine weather. Otherwise, however, no land birds were seen during the entire spring.

A final bit of negative evidence is this: about 50 miles southeast of Galveston lies the celebrated Heald Bank to which, in peacetime, fishing boats go by the dozen every spring and remain for several days at a time. But I have yet to find anyone who has seen any land bird on these expeditions.

In short, I have been unable to fiind any direct evidence of any trans-Gulf migration.

BIRDS ON THE TEXAS COAST

The second piece of evidence supporting the trans-Gulf migration theory was Cooke's belief that certain species common as migrants in Louisiana and northwestern Florida are rare or absent in Texas, as well as on the east coast of Mexico and the northwest coast of Cuba. Their absence could best be explained by the hypothesis of a direct trans-Gulf flight north from Yucatan.

As a matter of fact, however, until this very day we know practically nothing about bird migration in the immediate coastal region of eastern Mexico or northwestern Cuba. And not until 1936 was any extensive and consistent work done on bird migration along the Texas coast. In that year a group of highly competent observers began correlating their data, and in the intervening years have learned more about birds on the Texas coast than was ever known before. Special tribute must be paid to three people who have done an enormous amount of careful, thorough work in the immediate neighborhood of the Gulf and its bays: Mrs. Conger Hagar of Rockport, Mr. A. K. McKay of Cove, and Mr. J. M. Heiser of Houston and Kemah. Without them the present paper would have been impossible, and to them the author holds himself in grateful indebtedness. In the light of what they have learned, Cooke's several works on the distribution and migration of various groups, as well as his and Oberholser's articles on the migrations of North American birds appearing many years since in 'Bird-Lore,' would require drastic revision. Moreover, the 'Season' reports from Harlingen, Texas, published in the 'Audubon Magazine' a few years ago by Mr. Irby L. Davis, have added immeasurably to our knowledge. If the information that these observers have collected had been available to Cooke, he might not have been so strong a proponent of the trans-Gulf migration theory.

If this theory were really true, it does seem, as Cooke inferred, that species wintering entirely south of the United States and breeding between our Gulf Coast and the Arctic Ocean would appear as abundant spring migrants in Louisiana, northwestern Florida, and perhaps extreme eastern Texas, but would not appear in other parts of Florida or of Texas. But, as a matter of fact, ***no species appears in Louisiana and northwestern Florida that does not appear in at least equal numbers along the whole Texas coast, or on the keys and peninsula of Florida.***

The following table shows the presence or absence, and the abundance, of migrants in the regions indicated. In the table, *** means *regularly and frequently seen* each spring; ** means *regularly but not*

frequently seen each spring; and * means *seldom seen* in spring. "Lower Texas Coast" means from Rockport southward to the Rio Grande. Species occurring with equal frequency in all regions are ignored; they prove nothing either way. Rare or casual occurrences are likewise ignored.

If birds really migrated regularly and in numbers across the Gulf, the greatest number of stars in the table would fall in columns 3 and 4. But such is not the case; the greatest numbers fall in columns 1, 2, and 5. Furthermore, if any one species regularly migrated across the Gulf, the stars for that species would fall away in numbers to the left and right of columns 3 and 4. Actually, however, the number of stars for every species tapers off either from the right or from the left, so that in no case do more stars fall in columns 3 and 4 than in the column to the left or to the right. The only logical interpretation of these findings is that the species mentioned in the table migrate *around* the Gulf, via Florida or Texas, and not *across* it.

Another significant fact connected with the above table is this: a large number of species breed north and east of Florida and extend in winter well into Central or South America (Yellow-bellied, Alder, Least, and Olive-sided Flycatchers, Philadelphia and Warbling Vireos, Golden-winged, Tennessee, Nashville, Magnolia, Canada, and Chestnut-sided Warblers, Yellow-breasted Chat, and Dickcissel). If these birds really did cross the Gulf in spring, they would certainly appear as common migrants in Florida. Their rarity or absence in that state, together with their abundance all along the Texas coast, would indicate that these species were migrating *around* the western Gulf Coast—not directly across the Gulf.

MIGRATION DATES

The third and last pillar supporting the trans-Gulf theory is the fact that spring arrival dates on the Texas, Louisiana, and Florida coasts vary little from region to region. These practically simultaneous dates seemed to Cooke to prove that the new arrivals had come from directly across the Gulf in a single day or night; if they had come *around* the coast, there would be considerable differences in their arrival dates at different points on the coast.

Cooke put great faith in arrival dates because his famous work on migration up the Mississippi Valley had shown him that most species move forward in spring at the rate of something like 25 to 70 miles per day, and with considerable regularity. Consequently, the sudden arrival of birds all along a 1400-mile expanse of coast within a period or two or three days seemed to imply that the birds had crossed the Gulf in a single flight.

	1 *Lower Texas coast*	*2* *Galveston Bay region*	*3* *Southern Louisiana*	*4* *North-western Florida*	*5* *Florida keys or peninsula*
Golden Plover	***	***	***		
Hudsonian Curlew	***	***	**	*	***
Upland Plover	***	***	***	*	*
Knot		*	*	*	***
Pectoral Sandpiper	***	***	***	**	**
White-rumped Sandpiper	**	**	**	*	*
Baird's Sandpiper	***	*			
Stilt Sandpiper	***	**	*		**
Buff-breasted Sandpiper	***	***	*		
Black Tern	***	***	***	**	**
Black-billed Cuckoo	**	**	**	*	*
Gray Kingbird				*	***
Arkansas Kingbird	***	**	*		
Scissor-tailed Flycatcher	***	***	*		
Yellow-bellied Flycatcher	**	**	*		
Acadian Flycatcher	**	**	**	**	
Alder Flycatcher	**	**	*		
Least Flycatcher	**	**	*		
Olive-sided Flycatcher	*	*			
Bank Swallow	***	***	**	*	***
Rough-winged Swallow	***	***	***	**	
Cliff Swallow	?	***	**	**	*
Wood Thrush	**	**	**	*	**
Olive-backed Thrush	***	***	***	*	*
Gray-cheeked Thrush	***	**	**	*	***
Veery	***	**	*		*
Philadelphia Vireo	***	*			
Warbling Vireo	**	**	*		*
Swainson's Warbler		*	*	*	**
Worm-eating Warbler	?	***	**	*	**
Golden-winged Warbler	***	***	*		
Blue-winged Warbler	***	**	*	*	*
Bachman's Warbler			*	*	**
Tennessee Warbler	***	***	**		*
Nashville Warbler	**	**			*
Magnolia Warbler	***	***	**		*
Cape May Warbler					***
Black-throated Blue Warbler					***
Black-throated Green Warbler	***	***	***	*	*
Cerulean Warbler	**	**	**	*	*
Blackburnian Warbler	***	***	**	*	*
Chestnut-sided Warbler	***	***	**	*	
Bay-breasted Warbler	***	***	**	*	*
Black-poll Warbler			*	*	***
Louisiana Water-thrush	***	***	**		**
Kentucky Warbler	?	***	***	**	*
Yellow-breasted Chat	***	***	***	*	
Wilson's Warbler	*	*			
Canada Warbler	**	**	**		
Redstart	***	***	***	*	***
Bobolink			*	*	***
Baltimore Oriole	***	***	***	*	**
Rose-breasted Grosbeak	***	***	***	*	*
Blue Grosbeak	***	***	***	*	**
Painted Bunting	***	***	***	*	***
Dickcissel	***	***	***		

As a matter of fact, however, actual banding records show that birds may move faster than 25–70 miles per day. Individual Mallards are known to have traveled 200, 287, and 322 miles per day; a Blue-winged Teal averaged 100 miles per day on the long trip between Quebec and British Guiana; and a Lesser Yellow-legs averaged 385 miles per day between Cape Cod, Massachusetts, and Martinique, West Indies (Lincoln, 1939: 28–29).

At noon on July 12, 1932, I observed a flock of about 200 Common Canada or Lesser Canada Geese migrating north over Houston, Texas. So large a flock at that time of year is unknown in south Texas. At my request, a local radio station broadcast a message asking anyone who had seen the geese to communicate with me. Many people saw them as much as 20 miles north of where I saw them; one observer wrote that he had seen a flock of over 100 geese near Corpus Christi, Texas, at about 5 P. M., July 11, 1932, flying northeast around a bay. If this flock and the one seen in Houston were the same, the birds had traveled about 180 miles (in a straight line) overnight, although, since the birds were heading due north over Houston, they had probably followed the coastline to a point south of Houston—perhaps the mouth of the Brazos River—and then started north, covering a distance of about 210 miles overnight.

Rapid traveling such as this may help to explain why arrival dates along the Gulf Coast have no regular pattern but may appear almost simultaneous for a long stretch of coast.

Suppose we consider some arrival dates of birds that Cooke and others admit travel overland without crossing the Gulf.

In 1938, Bank Swallows arrived (or were first observed) in the Rio Grande Valley region on April 9; at Rockport, 120 miles to the north, April 7; and at Kemah, 170 miles northeast of Rockport, April 2. In 1940 they arrived at Rockport on April 18, and at Cove, 190 miles northeast of Rockport, on April 19. In 1941 they arrived at Rockport on April 19, and at Cove, April 14. In 1943 they arrived at Rockport on April 18, and at Cove, April 18.

In 1936, Barn Swallows arrived in the Rio Grande Valley on April 12; Cove, April 12; Pensacola, Florida, April 11. In 1937 they arrived in the Rio Grande Valley on April 11; at Rockport, April 8; at Cove, April 12; at Pensacola, April 2. In 1938 they arrived at Rockport on March 31; at Cove, March 29; at Kemah, April 2; at Pensacola, April 10. In 1942 they arrived at Rockport on April 8, and at Cove on April 8.

In 1936, Cliff Swallows arrived in the Rio Grande Valley on April 4,

and at Beaumont, Texas (near the Louisiana border), April 5. In 1943 they arrived at Rockport on April 17, and at Cove on April 19.

In 1940, Chimney Swifts arrived at Rockport on March 29; at Kemah, March 30; at Cove, March 24; and at Pensacola, March 27

In 1937, Nighthawks arrived in the Rio Grande Valley on April 29; at Rockport, April 23; at Kemah, April 21; at Houston, April 21; at Cove, April 13. In 1938 they arrived in the Rio Grande Valley on April 15; Rockport, April 17; Kemah, April 15; Houston, April 16; Cove, April 11; Pensacola, April 7. In 1940 they arrived in the Rio Grande Valley on April 14; Cove, April 17; Pensacola, April 14. In 1941 they arrived at Rockport on April 20; Kemah, April 19; Cove, April 19; Pensacola, April 10. In 1942 they arrived at Rockport on April 8; Houston, April 8.

At noon on April 8, 1942, thousands of Broad-winged Hawks began passing over Rockport, going northeastward parallel to the coast; the next day similar huge flights were seen at Cove and elsewhere at the north end of Galveston Bay. Presumably the migration had covered the 180–190 miles overnight.

Many other data could be given to show that birds which admittedly travel *around* the Gulf may inundate our entire Gulf Coast within two or three days. We must conclude, therefore, that *the fact that spring arrival dates for any species may be very close together for the entire Gulf Coast does not prove that the species in question has migrated across the Gulf of Mexico.*

Indeed, trying to prove anything from spring arrival dates along our Gulf Coast is an almost hopeless task. Observers living inland, or in the North where orderly migrations are the rule, do not realize the extreme complexity and seeming irregularity of migrations on the Gulf Coast. Here dates close to salt water and dates only two or three miles back from salt water may vary by weeks; the elevation (from sea level to 50 feet above) and the conformity of the land may determine the abundance or the complete absence of a species within a radius of two or three miles; places without cover along the generally bare and sandy Texas coast may be ornithological deserts, whereas an accidental thicket a hundred yards down the beach may be teeming with birds; many days of good weather may pass without the appearance of a single migrant, but the instant a northerly wind or a local shower comes, migrants may appear by the thousands. These facts, together with the circumstance that the number of consistent observers, who keep records, along 1,400 miles of coast may be numbered on the fingers of one's hands, deprive arrival dates of any wide significance.

EVIDENCE FOR COASTWISE MIGRATION

It was pointed out, early in this paper, that when we try to disprove any theory, we must confine ourselves to two logical processes: (1) showing that evidence for the theory is lacking, and (2) showing that a great deal of evidence supports a contrary theory. Up to this point, I have been trying to show that the evidence upon which Cooke and others based their trans-Gulf theory is entirely lacking or highly questionable. Next, I wish to show that there is excellent evidence that birds migrate *around* the Gulf in spring.

1. Royal Terns banded as young birds in the Galveston and Matagorda Bay regions of Texas are regularly recovered in late winter in Florida, many hundred miles due east of the banding place. If, as normally happens with most birds, these terns return to the general region of their birth, they must migrate along the coast in spring.

2. I have mentioned the flock of geese in summer and the migrating hawks that had probably followed the shoreline up from southern Texas.

3. Little Blue Herons do not breed in the immediate coastal area of Texas. But on several occasions in spring I have seen flock after flock of the birds (five to fifteen birds to the flock) beating rapidly up the outside shoreline of Galveston Island, a few hundred yards offshore. They would appear as mere specks far to the southwest of the place where I was standing, come abreast rapidly, and then disappear to the northeast, never pausing, and always maintaining their distance from the shore. They were obviously using the coast line as a migration route.

4. I have seen flocks of Eastern Kingbirds, flocks of Indigo Buntings, and many individual Yellow Warblers flying along the length of the island in spring, about half a mile back from the surf. For several miles a road parallels a thin line of cedar shrubs running in a southwest-northeast direction on the island, and I have driven slowly along this road and watched the birds mentioned flitting ceaselessly northeastward through the shrubs alongside the road.

5. Rough-winged, Bank, Barn, and Cliff Swallows have an invariable migration route along the coast in spring. A few hundred yards back from the beach, along every part of the Texas coast that I have visited in spring, they stream by the thousands all day long, and (except for an occasional straggler) are generally not seen more than a few hundred yards from the beach. These, too, are obviously using the coast line as a migration route.

6. According to the trans-Gulf theory, birds take off from southern

Mexico in the evening, and complete the flight across the Gulf by the next morning. But the facts are these. If one is along the Texas beaches during April and early May in good weather, one will see few migrants during most of the day. Near sunset, however, the occasional low thickets that one finds near the shore will begin to come alive with warblers, grosbeaks, Dickcissels, flycatchers, and other small birds. The inference is that the birds are seeking shelter for the night; and certainly they have not just arrived from a flight begun the preceding evening in southern Mexico. In this same connection, I should mention the fact that, at three o'clock in the morning of May 1, 1943, Mr. Ludlow Griscom and I, having started on a bird trip from Houston, heard above us the chirpings of thousands of birds moving northward. Mr. Griscom identified the birds as Veerys. It would have been physically impossible for these birds to have arrived over Houston at that time after leaving southern Mexico the preceding evening; and it seems incredible that the birds could have been on the wing since the second previous evening. We must believe, therefore, that the birds had not just migrated across the Gulf. More probably they were birds which had been migrating along the coast and which at some place on the coast (perhaps the mouth of the Brazos River) had diverged from the coast and struck off northward.

7. If birds migrated on a broad front straight across the Gulf and then went on inland, as they are generally supposed to do, one would expect them to be fairly evenly distributed over the entire hinterland back from the coast. But one of the most pronounced phenomena of the spring migrations in the region is the almost fabulous concentration of species and individuals just back of the beaches every spring, literally within a stone's throw of salt water, and the dearth of migrants a few miles inland. Grand Isle, off the southern Louisiana coast, is celebrated as a concentration point and resting place for birds that have supposedly just crossed the Gulf. Edward Stiles Hopkins (1929) reports having noted 102 species of birds there during the months of March, April, and May, 1927; and Mr. Hooker Oliver Lindsey (1931) records 103 species from the same place. But along the Texas coast, anywhere from Galveston Bay to the mouth of the Rio Grande, any single good 'bird day' will yield 125 species without trouble. In other words, there is a concentration of spring migrants, almost inconceivable to one who has not seen it, along the *entire* Gulf Coast, not merely opposite Yucatan. This fact, together with the virtual absence of spring migrants a mile or two back from the water, can be explained only by our assuming that the birds are migrating *along* the coast, not *across* it.

The concentration of birds along the coast and the dearth of them inland is most apparent during the first few weeks of April. Toward the end of April, and in May, migrants begin appearing inland as well as on the coast. Seemingly, the spring flight starts as a small rivulet of birds trickling up the coast; but as the season progresses, the rivulet grows into a river that overflows into the interior. See also Section 9, below.

8. Northern observers who are accustomed to seeing 'waves' of migrants on fine spring days may be surprised to know that most spring migrants are seen on the Gulf Coast during or just after bad weather. Indeed, any number of fine bright days may pass during spring with few or no migrants to be seen. But if a sudden shower, squall, or norther comes, the birds will drop to earth immediately. Here they may be counted by the scores and hundreds where, thirty minutes previously, not a bird was in sight. This sudden appearance of the migrants will occur (and occur invariably) *at any hour of the day when bad weather comes* in spring. Writing of his experiences on Grande Isle, Louisiana, Ambrose Daigre (1936) comments on this phenomenon: "I have noticed that very few migrants stop of their own accord when weather conditions are favorable for migration, but as soon as a dark cloud appears on the horizon accompanied by northwest wind, thousands of migrants drop from the sky like so many leaves."

The fact that the birds appear at a moment's notice is evidence that they are passing overhead continuously (during the migrating season) even though they are invisible. But a sudden shower, squall, or norther inland a little distance from salt water will result in no such deluge of migrants. Putting two and two together, therefore, we cannot help concluding that the birds must be migrating *along* the coast, not *across* it.

If they were really migrating across it after a trans-Gulf flight, the birds would become visible only when the arrival of bad weather coincided exactly with the hour and the minute when the birds were reaching the coast; furthermore, the bad weather would drive the birds to earth and make them visible in the interior as well as along the margins of sea and bay. The fact that neither of these conditions is realized casts doubt on the theory of trans-Gulf migration, and indicates instead that the birds migrate along the coast.

9. Presumably, as the migrants proceed along the Gulf Coast, they are continually funneled off northward by rivers and bays leading into the interior. In southern Louisiana an extensive system of bays, bayous, lakes, and rivers, including the great Mississippi, undoubtedly

serves as a most, probably *the* most, important funnel. A glance at the map will show other bay and river systems in Texas, Florida, Alabama, and Mississippi that probably serve as lesser funnels. My own experience with such diversionary systems, however, has been confined mostly to Galveston Bay.

Running almost at a right angle to the Gulf shore, extending many miles inland and ending at the north in the mouths of two large

TEXT-FIGURE 1.—Map showing probable migration routes around the Gulf of Mexico.

rivers, this bay forms an ideal arrangement both for bird migration and for the study of bird migration.

In spring, White Pelicans, cormorants, Water-Turkeys, ducks, geese, hawks, and swallows may be seen in enormous flights moving northward along the beach line of Galveston Bay. Moreover, small perching birds by the thousands concentrate, in bad weather, in the cover bordering the water. But back inland from the sides of the bay, few birds will be seen on even the most favorable days; a few hundred yards will spell the difference between an ornithological paradise and an ornithological desert. The abundance of birds at the bay's edge, the almost complete absence of migrants away from the water, and the actual sight of the migrating flocks—all these confirm the

theory that the birds are following the coast line during the spring migration. If they were not following the coast line, but were moving forward on a broad front from across the Gulf, they would be no more abundant along the edge of Galveston Bay than anywhere else. Moreover, since Yucatan lies considerably *east* of the longitude of Galveston Bay, one would expect any possible concentration of trans-Gulf migrants to be along the *eastern* shore of the bay. But, in my experience, the reverse has been true; the concentrations are along the western shore.

It would be foolish for any man to say that no birds ever fly northward across the Gulf of Mexico in spring, or to deny that some individual birds may fly across the Gulf every spring. Birds, like the weather of which they are so often the playthings, are always breaking rules and doing the unexpected.

Furthermore, birds undoubtedly cut chords across indentations in the coast, as suggested in the accompanying map. Finally, when the coastwise rivulet of migration expands into an overflowing river, as explained earlier in this paper, it is not impossible that the expansion may extend seaward as well as inland. Accordingly, toward the end of the season, a few birds may be found well out to sea. This last, however, is mere hypothesis.

CONCLUSION

There is no direct evidence to show that birds migrating from regions south of us in spring actually cross the Gulf of Mexico in any appreciable numbers; but there is abundant evidence to show that vast numbers of these birds, both individuals and species, take the coastwise routes *around* the eastern and western edges of the Gulf.

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NOTES ON PANAMANIAN BIRDS

BY JOHN W. ALDRICH

WHEN E. A. Goldman visited eastern Panama to collect birds and mammals for the U. S. Biological Survey in 1911 and 1912, that part of Central America was still virtually unexplored ornithologically. The explorations of the Italian naturalist, Festa, in the Rio Tuyra Valley, in 1895, seem to have been the only previous work. After Goldman brought back his fine collection from Porto Bello, Cerro Azul, Chepo, Rio Tuyra Valley, Mt. Pirri, and Cana, the late E. W. Nelson began its study and described many interesting new forms from it. Unfortunately, he was never able to complete his study and no comprehensive report was ever written on the birds, although some information about them was included incidentally in the report on the mammals of Panama by Goldman (1920: 25–42). Since that time several other collectors have worked in eastern Panama, and the region has become much better known. Nevertheless, there seem to be a few things left in the Goldman collection that have escaped more recent investigators.

In his lists of species characteristic of the Arid Lower Tropical Life Zone of Panama, Goldman (1920: 35) included '*Ammodramus savannarum obscurus*,' which was then the name used for the grasshopper sparrows breeding in southern Mexico. This publication, as well as the specimens on which it was based, have apparently been overlooked by subsequent investigators of the Panamanian avifauna, since there is no mention of the species as occurring in that country by either Hellmayr (1938: 495–501), or Griscom (1935). The three specimens of grasshopper sparrow, on which Goldman's (1920: 35) citation was based, were taken by him near Chepo, at the eastern end of the Pacific coastal savannas in eastern Panama. These include an immature male and a non-sexed adult specimen collected on the Rio Pacora, ten miles west of Chepo, altitude 100 feet, March 28, 1911; also an adult female taken ten miles northwest of Chepo, March 20, 1911. The immature male is interesting in that it is in process of molt from the juvenal plumage to the adult dress. Much of the head and back

plumage of the adult has already been attained, as well as about half of the buff and white ventral covering. Juvenal plumage remaining on the under parts shows the characteristic black streaking of the young of this species, but a much more yellowish ground color than in juvenile specimens of North American races, of which all that I have seen are practically white. To what extent this yellowish coloration is characteristic of continental tropical American grasshopper sparrows is not demonstrated by my material, which is otherwise totally lacking in specimens in juvenal dress. It does seem to be the rule in West Indian races, however. The presence of this practically juvenile example among the specimens from eastern Panama almost certainly proves that the birds were on or near their breeding grounds. Apparently they breed there during the dry season, which in that country extends from December to May. The two adult specimens are in fresh plumage, apparently having recently completed the postnuptial molt. They are slightly lighter and more heavily marked with chestnut above than a series of breeding specimens from Minatitlan, Vera Cruz, and Palenque, Chiapas. The latter, on the basis of van Rossem's (1934: 359) examination of the type specimen of *bimaculatus*, are considered typical of that race. With the small series at hand, however, it is impossible to say to what extent these differences are due to inequalities in amount of plumage wear. The Panamanian birds are certainly in fresher plumage than any of the Mexican examples of *bimaculatus* that I have been able to find. Compared with *A. s. caucae*, of northern Colombia, the Panamanian specimens are smaller, darker, and more brownish.

It is of interest to note that Carriker (1910: 910) refers grasshopper sparrows from northwestern Costa Rica to '*obscurus*' [= *bimaculatus*], and that three autumn specimens in the U. S. National Museum collected by A. Wetmore on the south slopes of the Volcan Rincon de la Vieja, Province of Guanacaste, northwestern Costa Rica, have also been identified as this race (Wetmore, 1944: 79). Thus it appears that *bimaculatus* ranges from southern Vera Cruz southward along the Pacific coastal savannas of Central America to eastern Panama.

Another species which seems to have eluded all collectors in Panama, except Goldman, is the sharp-tailed creeper (*Lochmias nematura*). Griscom (1935: 338) includes this species in his check-list of the birds of Panama, with the statement: "Mt. Pirri, Darien (fide Chapman)." Apparently Chapman had seen or heard about the specimens in the Biological Survey collection, since, as far as I am aware, they are the only ones that have ever been taken in that region. They are three

adult males taken at Mt. Pirri, eastern Panama, April 27, 1912, 4,500 feet, near the head of Rio Limon; May 1, at the same locality; and June 7, at 5,000 feet.

The late E. W. Nelson apparently had suspected that these specimens belonged to an undescribed race and had been investigating them, because after his death they were found set aside together with comparative material from South America, borrowed from the American Museum of Natural History. A careful comparison of this material shows that the Panamanian birds do represent a distinct subspecies which I am pleased to name after Dr. Nelson:

Lochmias nematura nelsoni, new subspecies

PANAMA SHARP-TAILED CREEPER

Type—Adult ♂, No. 238033, U. S. National Museum (Biological Survey Collection); Mt. Pirri, 4500 feet, near the head of Rio Limon, eastern Panama; May 1, 1912; E. A. Goldman; original number, 15635.

Subspecific characters.—Similar to *Lochmias nematura sororia,* of the northern Andes, but smaller and above more dusky, less rufescent (Prout's brown, instead of chestnut); below, brown areas more grayish and white spots reduced in size. Similar also to *Lochmias nematura obscurata,* from the Andes of Peru, but lighter and more rufescent, with ventral white spots much larger and more numerous.

Measurements.—Adult male (three specimens from Mt. Pirri, Panama): wing, 67.5–70.0 (68.3) mm.; tail, 40.5–45.0 (43.3); exposed culmen, 20.0–21.5 (20.7); tarsus, 22.5–23.0 (22.7); middle toe without claw, 19.0–21.0 (19.8). For comparison, a male from Cauca, Colombia, measures: wing, 74.5; tail, 49.0; exposed culmen, 21.0; tarsus, 25.0; middle toe without claw, 21.0. Two females from the same region of Colombia measure: wing, 70.0–74.0; tail, 45.5–48.5; exposed culmen, 19.5–20.0; tarsus, 23.0; middle toe without claw, 20.5–22.0.

Range—At present known only from the Upper Tropical Zone of Mt. Pirri, in the western part of the Province of Panama, Republic of Panama.

ACKNOWLEDGMENTS

I wish to express my thanks to the authorities of the Museum of Comparative Zoölogy, at Harvard College, the Carnegie Museum, and the American Museum of Natural History, for the loan of important comparative material.

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NOTES ON PEARL ISLANDS ORNITHOLOGY

BY ROBERT CUSHMAN MURPHY

DURING my expedition in the schooner 'Askoy,' under the auspices of the American Museum of Natural History, thirteen stations, chiefly marine, were worked in the vicinity of the Pearl Islands, Gulf of Panama. The dates were February 9–15 and May 23–26, 1941. A general statement on the expedition has appeared in Science (94 (no. 2429): 57–58, 1941) and other reports have been published, are in press, or are in preparation.

The birds collected by Mr. Jose G. Correia and the writer were mostly sea fowl, which are being studied in connection with specimens obtained elsewhere on the expedition. In addition, forty-seven examples of land and shore birds, which are the subject of this note, were collected at four islands of the archipelago, namely, Pacheca (at the northern end), Saboga, La Vivienda (an outlier of Bayoneta), and El Rey or San Miguel (the main island). Our San Miguel specimens were all taken in the Santelmo Bay district, at the south end of the island.

The principal sources of ornithological information about the Pearl Islands are the reports of Thayer and Bangs (Bull. Mus. Comp. Zoöl., 46: 137–160, 1905), and of Rendahl [Arkiv för Zoologi, 13 (no. 4): 1–56, 1920]. The latter author lists all the birds, resident and visitant, known up to his date of publication, a total of 100 species. The list has since been slightly increased by scattered records, all but a

few of which have been noted by Hellmayr (Catalogue of Birds of the Americas). Murphy (Oceanic Birds of South America: 320–322, 1936) has published a concise account of the archipelago and a chart showing all the islands.

The group numbers sixteen main islands and more than fifty islets, but San Miguel has a greater area than all the rest together. They are rocky and mostly wooded. The appearance of the vegetation differs markedly, nevertheless, from island to island, a fact probably due to the varying facilities for a standing water table in the soil during the long annual dry season of Pacific Panama. Not every island is inhabited by man, even where circumstances appear favorable.

The bird life presents similar discrepancies. As Rendahl has pointed out, several Isthmian families are lacking in the archipelago, despite its closeness to the mainland. On the other hand, flycatchers are represented by so many species that they make up a relatively high proportion (± 15 per cent) of the avifauna.

Yet there are wooded islands with few or no flycatchers—Contadora, for example—even though they are separated by only narrow straits from islands abounding in flycatchers, dipterid insects and standing water. The ecological controls are thus extraordinarily evident and graphic. No doubt they actually determine also the distribution of the human inhabitants to a far greater degree than the legendary explanations current in the archipelago. The large, green island of San José, for example, has no settlements because it is "haunted." Incidentally, it appears to support a perennial plague of mosquitoes, from which certain other islands are wholly or largely free.

The diversity of the islands could not be clearly apparent to naturalists without personal experience in the field. Thayer and Bangs, for example, refer to Saboga as the "bird rock" of the archipelago, whereas this island is probably the most luxuriant of all the larger members, and is exceptionally green and moist over much of its area, even throughout the dry season.

Mr. Correia, who has traveled much among the central and western Pacific archipelagoes, remarked frequently upon the striking superficial resemblance of the Pearl Islands to the Tonga group.

The following brief list may be of interest because of its extension of the insular ranges of several birds, its implications as to taxonomy and nomenclature, and its hints concerning the incidence of the breeding periods. In the latter connection it should be remembered that in February the dry season is in full sway, while in late May the wet season is just beginning.

BLACK VULTURE, *Coragyps atratus foetens* (Lichtenstein).—♀, Pacheca, February 10.

Rendahl refers to *"Catharista urubu,"* seen at Saboga, Bayoneta, and Señora, but lists no specimens. There is some doubt about the validity of this race, the type locality of which is Paraguay (*Cf.* Friedmann, Proc. Biol. Soc. Wash., 46: 187, 1933).

We observed also the Turkey Vulture (*Cathartes aura* subsp.?) at San Miguel and Pacheca, and collected one example which was unfortunately tossed overboard because of its offensive odor. It seems never to have been recorded from the Pearl Islands.

PEARL ISLAND HAWK, *Buteo magnirostris alius* (Peters and Griscom).—♀, with enlarged ovaries, San Miguel, May 23.

PEARL ISLAND CARACARA, *Milvago chimachima cordatus* Bangs and Penard.—♂ and ♀, with enlarged gonads, San Miguel, February 14; ♂, La Vivienda, May 23.

The discrepancy in size between the sexes is very marked.

AMERICAN OYSTER-CATCHER, *Haematopus palliatus palliatus* Temminck.—♂ and ♀, observed and collected as a pair, Pacheca, Feb. 10.

A group of four was seen at Santelmo Bay, San Miguel, on Feb. 14.

Both our specimens have white proximal primary shafts. In this, and in all other respects, they are identical with birds from the Atlantic and Gulf coasts of North America (*Cf.* Murphy, Oceanic Birds of South America: 974–975, 1936).

RED-WINGED DOVE, *Columbigallina talpacoti rufipennis* (Bonaparte).—♂, Saboga, February 12.

SMOOTH-BILLED ANI, *Crotophaga ani* (Linnaeus).—♀, La Vivienda, May 23.

RINGED KINGFISHER, *Megaceryle torquata torquata* (Linnaeus).—♀, with enlarged ovaries, San Miguel, February 14; ♀, La Vivienda, May 23.

SAN MIGUEL WOODPECKER, *Centurus rubricapillus seductus* (Bangs).—♂ and ♀, San Miguel, February 14, both with enlarged gonads; ♀, La Vivienda, May 23.

BERLEPSCH'S KINGBIRD, *Tyrannus melancholicus chloronotus* Berlepsch.—Eight specimens, four of each sex: Saboga, February 12, May 25; Pacheca, February 10; La Vivienda, May 23. One of the May females had enlarged ovaries.

This kingbird is a conspicuous form of islets and ocean fronts southward at least as far as Gorgona Island, Colombia. Our specimens from Gorgona, and from intermediate stations, agree with Pearl Island examples.

ZIMMER'S FLYCATCHER, *Myiodynastes maculatus difficilis* Zimmer.—♂ and ♀, the former with much enlarged gonads, Saboga, February 12.

PANAMA FLYCATCHER, *Myiarchus ferox panamensis* Lawrence.—2 ♀, La Vivienda, May 23.

BRAN-COLORED FLYCATCHER, *Myiophobus fasciatus furfurosus* (Thayer and Bangs).—♂, with enlarged gonads, La Vivienda, May 23.

SMOOTH FLYCATCHER, *Sublegatus glaber glaber* Sclater and Salvin.—♂, with enlarged gonads, La Vivienda, May 23.

SAN MIGUEL BANANAQUIT, *Coereba flaveola cerioclunis* Bangs.—♂ and ♀, both in breeding state, Saboga, February 12.

FLESH-LEGGED HONEY-CREEPER, *Cyanerpes cyaneus carneipes* (Sclater).—4 ♂, all with much enlarged gonads, Saboga, February 12.

PROTHONOTARY WARBLER, *Protonotaria citrea* (Boddaert).—♀, Pacheca, February 10.

PANAMA GOLDEN WARBLER, *Dendroica petechia aequatorialis* Sundevall.—3 ♂, Saboga, one February 12, the others May 25. Only one of the May birds had enlarged gonads.

BALTIMORE ORIOLE, *Icterus galbula* (Linnaeus).—♀ immature, Saboga, February 12.

NORTHERN BLUE TANAGER, *Thraupis episcopus diacona* (Lesson).—2 ♀, Pacheca, February 10; ♂, 2 ♀, Saboga, February 12, May 22 and 25; ♀, La Vivienda, May 23.

Two of the May birds had enlarged gonads.

PEARL ISLAND TANAGER, *Ramphocelus dimidiatus limatus* Bangs.—♂, with greatly enlarged gonads, Saboga, February 12.

PEARL ISLAND SALTATOR, *Saltator albicollis speratus* Bangs and Penard.—♂, Saboga, February 12.

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SEX RATIOS OF DUCKS IN SOUTHWESTERN WASHINGTON

BY JAMES R. BEER

THIS study of the sex ratios of ducks in southwestern Washington covers the periods of fall migration, winter residence, and spring migration. Due to the late date at which some of the ducks complete the molt to adult plumage, most of the data were obtained during the winter and spring periods.

The object of this survey is to determine the make-up of the populations of the various species that use this portion of the Pacific flyway. A qualitative survey of the duck populations is as important to the

management of the various species as the more frequent quantitative surveys.

Detailed information on the sex ratios is given by the months in Table 1.

METHOD OF MAKING COUNTS

The counts were made of the various species as early in the season as possible. The limiting factors in the determination of the sex of waterfowl were the completion of the post-nuptial molt of the adult males, and the change of the immature males from juvenal plumage to adult plumage complete enough for field identification. These vary greatly with the different species. To obtain records of sufficiently large numbers of birds, it was found that field identification of the live birds was the only method that gave satisfactory results.

Much of the work was carried on from a small boat propelled by oars, as it was more satisfactory to approach the birds by this method than by using a motor. Nearly all of the fall and winter observations were made by this method, although the spring observations were mainly from shore. During the spring, the ducks spent most of their time along the shores of the large bodies of water and on the smaller ponds, while in the fall and winter they were found mainly on the larger lakes and the Columbia River. This was due to the lack of water in the small pond areas during winter and the effect of hunting pressure.

Several methods of making the counts were tried. These included counting hunters' bags and making field observations. Counting hunters' bags was found not to be practical as the day's bag would not agree with field observations. Then, too, the number of the birds counted by this method did not justify the time spent. The field observations were made either alone or with two people working together. When working alone, it was found that one must count all of each sex separately and then recount the entire flock. When two people worked together, one observed and called out the sex and species while the other tallied the results. Not only were these results more accurate, but the number of counts per man hour were greatly increased.

When one has to count each sex separately it is nearly impossible to count birds in flight or when there is any movement in the flock. A small flock leaving or arriving will make the previous counts useless. It is much simpler to count large rafts of mixed species by counting everything, starting at one end of the raft and counting straight through to the other end. As an individual flock or raft is usually

TABLE 1

SEX RATIOS OF 15 SPECIES OF DUCKS BY MONTHS
1943-1944

SPECIES	SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		APRIL		TOTAL	
	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀	TOTAL	RATIO ♂ ♀
MALLARD	26	1.00-1	38	1.00-1	179	1.33-1	238	1.00-1	713	1.04-1	202	0.91-1	226	0.93-1	30	1.14-1	1652	1.03-1
GADWALL	0		0		9	1.25-1	0		0		18	1.00-1	0		0		27	1.08-1
BALDPATE	0		3	0.50-1	12	1.00-1	90	1.20-1	602	1.05-1	1138	1.21-1	3027	1.14-1	127	1.15-1	4999	1.14-1
PINTAIL	0		17	1.13-1	20	1.50-1	37	1.31-1	224	1.11-1	307	1.05-1	17	0.89-1	0		622	1.09-1
GREEN-WINGED TEAL	0		9	0.80-1	18	1.00-1	32	1.00-1	84	1.16-1	247	0.99-1	229	1.03-1	26	1.00-1	645	1.02-1
SHOVELLER	0		0		0		22	0.86-1	39	1.29-1	32	1.29-1	6	1.00-1	2	1.00-1	101	1.15-1
WOOD DUCK	0		0		0		0		0		0		32	1.13-1	29	1.23-1	61	1.18-1
ANATINAE	26	1.00-1	67	0.97-1	238	1.29-1	419	1.05-1	1662	1.06-1	1944	1.12-1	3537	1.12-1	214	1.14-1	8107	1.11-1
REDHEAD	0		0		2	2.00-0	5	1.50-1	4	1.00-1	4	1.00-1	0		0		15	1.50-1
CANVAS-BACK	0		1	0.00-1	2	1.00-1	0		74	1.96-1	193	2.51-1	46	1.30-1	0		316	2.10-1
LESSER SCAUP	0		0		0		41	1.28-1	10	1.00-1	161	1.24-1	659	1.56-1	40	1.86-1	911	1.49-1
AMERICAN GOLDEN-EYE	0		0		7	7.00-0	0		0		7	0.75-1	0		0		14	2.50-1
BUFFLE-HEAD	0		0		7	0.75-1	1	1.00-0	0		0		0		8	0.60-1	16	0.78-1
NYROCINAE	0		1	0.00-1	18	2.33-1	47	1.35-1	88	1.75-1	365	1.74-1	705	1.55-1	48	1.53-1	1272	1.61-1
AMERICAN MERGANSER	0		5	4.00-1	35	1.69-1	315	1.39-1	309	1.69-1	95	0.86-1	7	0.00-7	7	0.17-1	773	1.38-1
RED-BREASTED MERGANSER	0		0		0		0		0		0		17	1.43-1	0		17	1.43-1
MERGINAE	0		5	4.00-1	35	1.69-1	315	1.39-1	309	1.69-1	95	0.86-1	24	0.71-1	7	0.17-1	790	1.38-1
RUDDY DUCK	0		0		0		0		8	3.00-1	1	0.00-1	0		2	1.00-1	11	1.75-1
ERISMATURINAE	0		0		0		0		8	3.00-1	1	0.00-1	0		2	1.00-1	11	1.75-1
ANATIDAE	26	1.00-1	73	1.03-1	291	1.38-1	781	1.19-1	2067	1.17-1	2405	1.18-1	4266	1.17-1	271	1.15-1	10180	1.18-1

of an even composition as to sex, the data obtained from counting a portion of the flock are good. Often a raft will break up before a complete count is possible.

AREA STUDIED

The area studied is limited to a strip along the Columbia River from White Salmon, Klickitat County, Washington, to Ridgefield, Clark County, Washington. All but one day's observations were from the northern side of the Columbia River.

Most of the winter observations were made on Vancouver Lake, a lake with an area of about five square miles in Clark County, Washington. After the middle of February, the ducks were found to be on the smaller ponds and sloughs. This change was probably due to the birds going back to their preferred habitats after the closing of the hunting season. The winter was very mild and after this date no ice was formed on these smaller ponds. It was in this general area that the majority of the Anatinae and Merginae were observed. Most of the Nyrocinae were observed on the Columbia River where the water was deeper.

WEATHER CONDITIONS

Weather conditions affect the local movements of waterfowl in this area. As this winter (1943–1944) was mild, the larger lakes and all of the streams were open throughout the winter. Also, the winter rainfall was below normal, but not to the extent of appreciably lowering the quantity of open water used by the ducks. Due to the mild weather, many thousands of ducks remained in the area throughout the winter. Large flocks of Canada Geese and a few snow geese also wintered here this year.

The variation in the sex ratios of the ducks during the progress of the migration was noted only in a few cases. There was little or no clumping of the sexes due to the changes of temperature. The ratios remained the same throughout the winter period and both early and late migratory periods for most species.

After the middle of February, any series of two or three warm days would send another flow of ducks into the north. This locality is apparently off the regular route taken by certain species such as the Pintail and Shoveller.

DISCUSSION

Mallard, *Anas platyrhynchos*.—The Mallard is one of the most common winter ducks, as well as the main breeding species for this area. It is common at all times of the year though more numerous during

the winter months. Counts for this species were started early in the fall before the migrants from the north arrived. During this period the sex ratio of males to females ran 1.00 to 1. With the arrival of the birds from the north there was a slight rise in the number of males in proportion to the females. After the wintering birds had left for the north it was found that the ratio was slightly high in favor of the hens. This agrees with counts of the hunters' bags in that more drakes than females were killed. Due to the lack of predators in this area it is doubtful if many nesting females are killed. The excess of males in the wintering ducks is probably due to conditions on the breeding grounds.

The ratio as a whole is very evenly balanced. For the total of 1,652 birds observed the ratio was 1.03 to 1. The last observations, during the middle of April, showed a slight increase in males, but this was more apparent than real, as some of the females had begun to take up nesting activities.

Gadwall, *Chaulelasmus streperus*.—Very few Gadwalls were seen during this study. There were only 27 individuals identified to sex with a ratio of 1.08 to 1. When compared with other species of similar habits, it seems that this ratio is quite representative.

Baldpate, *Mareca americana*.—This is one of our most prominent winter and spring residents. It is found in large flocks in most of the lowland areas where its habit of grazing makes it quite conspicuous. Of the 4,999 Baldpates sexed, 2,667 were males and 2,332 were females which gives a ratio of 1.14 to 1. It is interesting to note that individual flocks of about 500 individuals would vary greatly in sex ratios. This variation ran from as high as 1.26 to 1 to as low as 1.08 to 1. In the smaller flocks the ratios varied a little more. The variation is greater in this species than with the others in its subfamily.

There was very little over-all variation in the ratios of the Baldpates until the last of the migration during the first part of April. At this time the mated birds tended to be among the first to migrate, leaving a small number of unmated birds; this gave a slightly higher ratio in favor of the males—a ratio of 1.24 to 1. The small number of birds seen during this late spring period did not affect the over-all ratio of 1.14 to 1.

American Pintail, *Anas acuta tzitzihoa*.—The Pintail is one of the common spring and fall ducks. While it is to be found throughout the winter, its numbers are greatly reduced during the colder weather. Six hundred and twenty-two Pintails were counted, 325 males to 297 females, which gives a ratio of 1.09 to 1. The ratio varied as the

season changed. During the fall and winter periods the ratio was 1.10 to 1, while during the last of the season the ratio became as low as 0.89 to 1. Due to the small number of birds in the area during the last spring period, the ratio of 1.10 to 1 should be taken as the nearest to the true ratio for this species.

Green-winged Teal, *Anas carolinensis*.—This small duck was very abundant during the entire study, but only 645 birds were determined as to sex. The erratic flight made positive identification of sex very difficult. Of those identified, 326 were males and 319 females, or a ratio of 1.02 to 1. In this species the sex ratio remained quite constant throughout the period of study. The ratio of 1.02 to 1 is one of the most even found, being slightly more even than that of the Mallard.

Shoveller, *Spatula clypeata*.—One hundred and one Shovellers, 54 males and 47 females, were counted to give an over-all ratio of 1.15 to 1 for the year. The first counts were made during the last of December when the males were far enough along in their molt to assure accurate counts. The ratios were fairly constant throughout the winter, but during March and April only occasional mated pairs were seen.

Wood Duck, *Aix sponsa*.—Observations of the Wood Duck were made only during the spring period; the earliest observations were on March 12. The lack of previous observations is not accounted for as this duck is known to be found in this area throughout the year. Thirty-three males and 28 females, a total of 61, were checked, giving a ratio of 1.18 to 1. At no time were more than four or five Wood Ducks seen together. They were among the wildest of the ducks observed even though they were in active courtship performance during most of these observations.

Redhead, *Nyroca americana*.—Few birds of this species were seen during the period of this study. Fifteen individuals, nine males and six females, were observed, giving a ratio of 1.50 to 1. This indicates a tendency toward an excess of males, though the number of birds observed was too small for definite conclusions.

Canvas-back, *Nyroca valisineria*.—The presence of the Canvas-back in this area was sporadic. The flocks seemed to be quite nomadic in habit and were seldom found in the same area during any two consecutive observations. In all, 316 individuals were sexed, 214 males and 102 females, for a ratio of 2.10 to 1. It was found that the ratio was more unbalanced in the large flocks than in the smaller groups. There was also a tendency for the winter groups to have a higher proportion of males than the spring groups. This indicates that the males migrate earlier than the females. These birds were found on

both the shallow ponds and the deep water of the Columbia River. The ratio in this species is the most unbalanced of any of the common ducks in this area.

Lesser Scaup Duck, *Nyroca affinis*.—The Lesser Scaup Duck is the most common of the diving ducks in this area. It was found primarily on the Columbia River. Totals of 911 individuals, 545 males and 366 females, were observed. The sex ratio for the entire group was 1.49 to 1. While individual flocks varied considerably in sex ratio, very little variation was found during the progress of the season.

American Golden-eye, *Glaucionetta clangula americana*.—Only two small flocks of the American Golden-eye were seen. Totals of 14 birds, 10 males and 4 females, were observed, which gives a ratio of 2.50 to 1. This indicates that there is an excess of males though the true ratio may vary considerably from this figure.

Buffle-head, *Charitonetta albeola*.—The Buffle-head was not a common duck in this area. Only 16 individuals were determined as to sex. The ratio was 0.78 to 1, but it is felt that this may not be representative.

American Merganser, *Mergus merganser americanus*.—The American Merganser was the only species in which there was a noticeable separation of the sexes. The sexes were found in more or less pure flocks. While no definite rule can be stated as to the composition of the various flocks, the typical flock consists of about seven males and one female or four or five females either alone or with a single male. On occasion, flocks of quite even sex distribution are seen. Not only were the sexes found separately but the type of water occupied and the migratory movements were different.

For the entire period of study, 773 birds, 448 males and 325 females, were observed in a ratio of 1.38 to 1. From field observations it is felt that this ratio is not correct. The females are far less nomadic than the males and tend to inhabit the comparatively quiet waters of the larger lakes and sloughs while the males tend to stay in the swift waters of the rivers. With the coming of spells of cold weather the males join the females on the larger lakes. It is probable that the ratio of 1.55 to 1 that was derived from the winter observations is nearly correct.

About the first of February, the males started for their nesting territories, and by the 10th of March one seldom saw a male American Merganser even though the females were commonly seen as late as the last of March.

During the colder weather, large rafts of American Mergansers were found well out on the larger lakes, swimming around and resting on

the ice floes. While these large rafts were composed of mixed sexes, basically they were composed of small groups of 3 to 25 individuals, mainly of a single sex.

Red-breasted Merganser, *Mergus serrator*.—Only 17 of these mergansers were seen. The ten males and seven females give a ratio of 1.43 to 1. When compared with the American Merganser, it appears probable that this ratio is fairly representative.

Ruddy Duck, *Erismatura jamaicensis rubida*.—Seven males and four females were seen, giving a ratio of 1.75 to 1. These ducks were very difficult to sex except on clear, bright days.

CONCLUSIONS

It was found that, as a whole, the puddle ducks have a quite even sex ratio. The Wood Duck and Baldpate deviate from this pattern to some extent. The diving ducks and mergansers were found to have comparable sex ratios. These ratios were usually considerably higher in favor of the males than that found in the puddle ducks.

From field observations and a number of hunters' bags observed, it would seem that during the fall and winter more males than females are killed. This would not necessarily mean that the male is more vulnerable than the female but rather that the males are more abundant. The exception to this seems to be the Mallard where the fall ratio is quite even while the spring ratio favors the females in the local breeding birds.

Where the ratio is unbalanced in favor of the males, it will be necessary to go to the nesting and molting areas to determine the cause. Nothing indicating the cause of this difference was noted during the present study.

SUMMARY

During the fall, winter, and spring observations of 1943 and 1944, 10,180 ducks of 15 species were counted as to sex. For this entire group it was found that there was a sex differential in favor of the males. The ratio was found to be 1.18 to 1.

As a general rule, there was little difference in the sex ratios during the changes of season and only a slight tendency for the males to leave the wintering areas first.

The Anatinae were found to have quite an even sex ratio while the Nyrocinae and Merginae were unbalanced in favor of the males.

Vancouver
Washington

FLYING ABILITY AND THE ANTERIOR INTERMUSCULAR LINE ON THE CORACOID

BY HARVEY I. FISHER

THE student of functional osteology working with either Recent or fossil material often times must attempt to reconstruct the myological pattern by study of the muscle scars on the various bones. In birds, the coracoid is one of the elements most frequently encountered in the fossil record. To complete a phylogenetic picture of flight in a family which includes fossils, it frequently is desirable to speculate on the evidence furnished by the coracoid.

In 1931, Lambrecht (Proc. VIIth. Internat. Ornith. Congress, Amsterdam, 1930: 79–81) noted in fossil and Recent cormorants a difference in the position and configuration of the anterior intermuscular line on the coracoid. Medial to this line is M. supracoracoideus (M. pectoralis secundus); lateral to it is M. coracobrachialis posterior (M. pectoralis tertius) (Text-fig. 1). Lambrecht inferred that the line separated parts of the origins of the two muscles and stated that shifting of the line laterally indicates increased size of M. supracoracoideus and consequent better "flying ability." His corollary to this thesis was that M. coracobrachialis posterior decreases in size as M. supracoracoideus increases.

Several objections may be raised to this interpretation of the significance of this particular intermusclar line. First, the main origin of M. supracoracoideus is from the sternum and not the coracoid; in the cathartid vultures at least, there is very little coracoidal origin. The medial edge of the origin of M. coracobrachialis posterior is, however, defined by the line. Secondly, M. supracoracoideus in many birds becomes tendinous in the region of the proximal part of the coracoid; thus the width of the coracoid covered by it varies with the width and the length of the tapered tendon, rather than with the development of the fleshy part of the muscle in which resides the actual power-potential. Thirdly, there is no reason to believe that increase or decrease in one of these muscles must necessarily result in decrease or increase in the other muscle. M. coracobrachialis posterior is free to expand laterally, and it does not always occupy all of the area lateral to the muscular line. M. supracoracoideus may and often does extend its origin medially and anteriorly on to the furculum. Ventrally, both are covered by M. pectoralis superficialis. In the Cathartidae, M. supracoracoideus overlaps the medial edge of M. coracobrachialis posterior and thus can expand without causing any corresponding change in the intermuscular line.

Still another criticism is that the line on the coracoid does not in all cases agree with the line on the sternum as to the lateral extent of the origin of M. supracoracoideus. In *Diomedea nigripes,* for example, the line on the sternum is much farther laterally than the coracoidal line when the two elements are articulated.

Miller (Univ. Calif. Publ. Zoöl., 42: 51, 1937) has voiced well-

TABLE I

STERNAL WIDTH OF IMPRESSION OF M. SUPRACORACOIDEUS ON CORACOID*

	Number of specimens	*Average*	*Range*
Diomedea nigripes	3	43.8	41.8–46.4
Gavia pacifica	4	33.9	31.9–35.9
Gavia stellata	7	33.8	32.1–35.9
Gavia immer	3	33.6	32.9–34.7
Cathartes aura	9	32.5	30.5–33.6
Sarcoramphus papa	2	31.7	31.1–32.4
Elanus leucurus	4	31.6	28.2–33.4
Cygnus columbianus	4	31.0	28.1–32.4
Gymnogyps californianus	5	30.2	28.9–31.2
Anas carolinensis	9	29.8	27.7–32.4
Anas platyrhynchos	7	29.7	28.2–31.7
Buteo borealis	7	29.5	26.7–31.3
Falco mexicanus	10	29.1	26.1–31.3
Anas cyanoptera	5	29.0	26.8–30.7
Branta c. minima	5	29.0	27.7–30.4
Falco peregrinus	4	28.6	28.0–29.2
Coragyps atratus	5	28.5	27.8–29.4
Branta c. canadensis	2	28.5	28.3–28.7
Branta c. hutchinsi	3	27.8	27.0–28.8
Falco sparverius	7	27.2	25.4–28.8
Falco columbarius	5	25.8	24.4–27.5
Accipiter gentilis	7	25.2	24.2–26.1
Ardea herodias	4	24.9	21.7–26.9
Oreortyx picta	5	23.8	22.0–25.9
Accipiter cooperi	5	23.2	22.0–24.5
Corvus corax	9	22.3	20.2–23.2
Phalacrocorax auritus	4	22.1	21.2–23.8
Corvus brachyrhynchos	9	21.6	20.4–22.6
Accipiter velox	8	19.7	18.4–21.6
Colinus virginianus	3	19.0	18.4–19.9
Anhinga anhinga	1	18.4	
Pelecanus occidentalis	4	15.4	14.7–16.6

* Expressed in per cent of coracoidal length.

founded suspicions as to the accuracy of our knowledge of the intricate functions of M. coracobrachialis posterior and its relationship to the action and relative development of M. supracoracoideus.

With these thoughts in mind, I examined the coracoids of a number of birds, and to obtain a mathematical expression of the position of the anterior intermuscular line measured the total length of the coracoid, the greatest sternal width of the coracoid and the sternal width of the coracoid medial to the muscular line in some 32 species. These species were selected to demonstrate different types of flight.

The width of the space supposedly occupied by M. supracoracoideus is expressed in per cent of coracoidal length in Table 1 and in per cent of the sternal width of the coracoid in Table 2. Admittedly, the measurements may not in all cases portray the exact situation, since the line may be in a different position farther anteriorly on the coracoid. However, as discussed previously, the more proximal part

TABLE 2

STERNAL WIDTH OF IMPRESSION OF M. SUPRACORACOIDEUS ON CORACOID*

	Number of specimens	*Average*	*Range*
Sarcoramphus papa	2	79.4	77.8–80.9
Corvus corax	9	77.6	71.0–80.2
Falco mexicanus	10	77.1	72.0–83.3
Corvus brachyrhnychos	9	76.0	70.4–80.0
Cathartes aura	9	75.7	72.8–77.7
Falco sparverius	7	75.2	71.0–78.3
Coragyps atratus	5	72.5	70.7–73.9
Falco peregrinus	4	72.3	70.1–75.4
Cygnus columbianus	4	71.9	69.4–73.8
Falco columbarius	5	71.6	68.3–75.3
Anas cyanoptera	5	71.6	68.8–74.4
Gymnogyps californianus	5	71.2	70.2–72.0
Branta c. minima	5	71.1	68.7–74.7
Anas carolinensis	9	70.9	67.5–73.8
Anas platyrhynchos	7	70.7	66.8–75.9
Oreortyx picta	5	70.7	68.0–72.4
Branta c. hutchinsi	3	70.3	69.0–70.9
Branta c. canadensis	2	69.6	68.7–70.3
Elanus leucurus	4	68.1	64.7–70.5
Buteo borealis	7	65.6	60.3–69.8
Colinus virginianus	3	64.7	60.3–68.8
Ardea herodias	4	64.6	62.2–67.0
Gavia stellata	7	62.3	60.2–65.6
Gavia immer	3	61.8	61.3–62.3
Accipiter gentilis	7	59.8	56.9–62.1
Gavia pacifica	4	59.5	52.4–64.1
Accipiter cooperi	5	58.4	56.8–59.5
Phalacrocorax auritus	4	54.8	53.8–58.2
Accipiter velox	8	52.0	48.7–55.2
Diomedea nigripes	3	51.1	48.8–53.3
Anhinga anhinga	1	49.0	
Pelecanus occidentalis	4	35.4	34.6–36.6

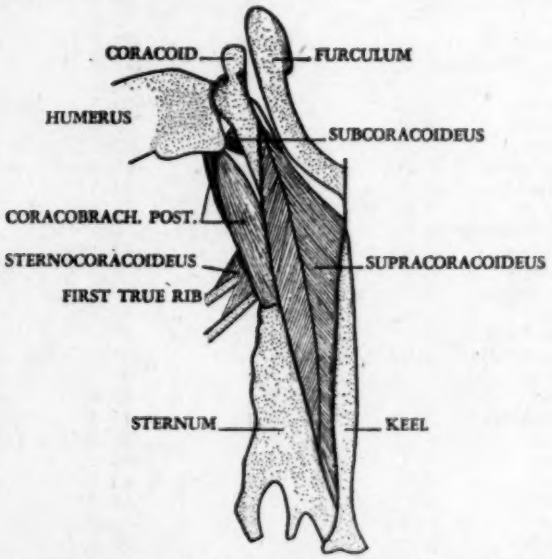
* Expressed in per cent of greatest sternal width of coracoid.

of the area is a more reliable indicator of the development of M. supracoracoideus because the muscle has not yet become attenuated and has not formed its tendon of insertion. Except for the crow and raven, no passerines were measured because their small size makes too great the error in measurement.

In examining the coracoids and in reviewing the data furnished by the measurements, I found no correlation between the position of the anterior intermuscular line and any type of flight, size, or phylogenetic position. One might expect similarities in the ratios within a closely

related group because of similarities in width and configuration of the sternocoracoidal articulation. A glance at the tables shows no such correlation among the various genera of the Cathartidae or among the species of *Falco* and *Accipiter*.

The wide separation in the ratios of such a notably soaring family as the Cathartidae by such forms as *Elanus, Falco, Anas carolinensis,* and *Cygnus,* and the disparity in the ratios of the various species of *Falco* negate any correlation with either soaring or swift, flapping flight. Also note the dissimilarity between *Pelecanus* and *Diomedea* and between the species of *Accipiter*.



TEXT-FIGURE 1.—Ventral view of the deep breast musculature in *Coragyps atratus* (× ¼).

Apparently the position is not correlated with speed of flapping flight, either, for *Ardea* and *Pelecanus,* both relatively slow, laborious flappers, are separated in the tables by such forms as *Oreortyx, Accipiter gentilis, Accipiter velox,* and *Anhinga*. Comparisons of two species within a genus, such as *Corvus corax* and *Corvus brachyrhynchos,* show no significant differences although the raven uses a slower wing beat. Likewise, the differences between *Anas carolinensis,* a fast flyer, and *Anas platyrhynchos* are negligible.

The fast, whirring flight of the quail as it gets off the ground is well known, yet *Oreortyx* and *Colinus* rank relatively low in the series as indicated by the ratios, and their ratios are separated by those of forms like *Branta, Elanus,* and *Phalacrocorax*.

The volumes of M. supracoracoideus and M. coracobrachialis posterior were measured in all the genera of the Cathartidae. Expressed in per cent of total volume of the wing musculature, the volumes of M. supracoracoideus are: *Vultur,* 7.3; *Coragyps,* 6.5; *Sarcoramphus,* 5.8; *Gymnogyps,* 5.1; and *Cathartes,* 4.4. Judging from the ratios of Table 1, the series in order of decreasing development of M. supracoracoideus would be *Cathartes, Sarcoramphus, Gymnogyps,* and *Coragyps.* From Table 2, the same series is *Sarcoramphus, Cathartes, Coragyps,* and *Gymnogyps* (no coracoids of *Vultur* were available). Thus it appears that in the New World vultures the position of the line on the coracoid is not an index to the volume of the muscle which, in turn, is the best gross index to its power. The volumes of M. coracobrachialis posterior, expressed in per cent of total volume of wing musculature, vary between 0.93 per cent in *Sarcoramphus* and 1.16 per cent in *Gymnogyps,* a negligible range of some 0.2 per cent. These figures indicate that M. coracobrachialis posterior does not vary inversely in its developments with M. supracoracoideus.

Consequently, it seems necessary to discard the anterior intermuscular line on the coracoid as an index to the ability to fly. There are too many complications in the form of synergistic actions of the muscles and in the stimuli supplied to them through the nervous system for any such simple criterion to be significant.

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SOME CHANGES IN THE BIRD LIFE OF CHURCHILL, MANITOBA

BY A. A. ALLEN

ON May 1, 1934, P. A. Taverner and G. M. Sutton published a carefully prepared, annotated list (1) of the birds that had been recorded from Churchill, Manitoba, up to July, 1933. In 1934, I spent the month of June at Churchill studying ptarmigan (2) in the interest of the American Game Association and found this list most useful, while my observations on the relative abundance of the various species checked rather accurately with those reported by Taverner and Sutton. Ten years later, 1944, I spent most of the month of June again at Churchill, under the auspices of the National Geographic Society, this time with my son David, and since the status of certain species seems to have changed in this interim and since the area will probably undergo additional changes, it seems advisable to report our observations at this time.

David and I arrived at Churchill on June 7 and during the first week we enjoyed the company of Frank A. Farley of Camrose, Alberta, veteran egg collector, who had made several previous trips to Churchill. During the last week of our stay, June 22 to June 28, we were accompanied by William Carrick of Toronto, a sergeant in the Canadian Air Force, who had come to Churchill to photograph birds.

With the completion of the railroad from Winnipeg to Churchill in 1929, the nesting ground of the Harris's Sparrow and a number of shorebirds, whose eggs were great rarities, at that time became available to collectors and perhaps no similar area has received more intensive egg-collecting in recent years.

With the entrance of the United States into the World War, still greater catastrophes befell Churchill, for there was an influx of 3,500 workmen for the installation of a modern airport and for the building of a wide gravel road through the heart of the nesting grounds. From there it extends some miles south to Landing Lake. Deepened ditches have drained the town-site somewhat more effectively than formerly and much of the area from the town to the reservoir has become drier. Most of the dwarf spruces that dotted this area have likewise been cleared off.

In building the landing strips, spruce-covered ridges that represented ancient beaches were levelled off so that this part of the Churchill area is no longer recognizable by those who knew it in the pre-war days. In spite of all these happenings, it was interesting to discover birds like the Hudsonian Curlew, Eastern Dowitcher, and Red-backed Sandpiper fully as numerous as in 1934, with the Curlews and Dowitchers considerably more abundant. Of the rarer shorebirds, only the Stilt Sandpipers seemed somewhat less common.

Of the 142 species of birds listed by Taverner and Sutton as of regular or accidental occurrence at Churchill, we recorded 75. Most of those not recorded are either accidental or transients that would not normally be seen during the period of our visit. In addition to the 75 species previously recorded, we observed seven not included on the Taverner-Sutton list, as follows. None of these was collected but they represent common species familiar to the observers. The exact subspecies, where several have been recognized, cannot, of course, be vouched for.

ALDER FLYCATCHER, *Empidonax t. traillii* (Audubon).—One singing male observed on June 12 by David Allen at timberline south of the reservoir.

BARN SWALLOW, *Hirundo rustica erythrogaster* Boddaert.—One adult male seen by the author June 17 flying over the town with a pair of Tree Swallows that was nesting in a bird house.

HOUSE WREN, *Troglodytes aëdon* Vieillot.—A male House Wren was first seen and heard singing by David Allen near some old army hospital buildings south of the reservoir on June 21. It was heard by the author on the following day not far from the same spot.

STARLING, *Sturnus v. vulgaris* Linnaeus.—A flock of four first seen by the author June 12 circling over a pond at timberline south of the reservoir. When I 'squeaked' they alighted in the spruces within fifty feet of me. On June 15 in the same area, three were seen again flying together, one of them having lost its tail.

COWBIRD, *Molothrus ater* (Boddaert).—On June 10 in the same general area where the Starlings were later seen, a female Cowbird was observed twice. The first time t was being chased by a Rusty Blackbird and the second time by a male Red-wing.

RED-WING, *Agelaius phoeniceus* (Linnaeus).—An adult male was first seen June 10 and repeatedly thereafter in the alder-spruce swamp which constitutes the edge of timberline just south of the reservoir.

SONG SPARROW, *Melospiza melodia* (Wilson).—A male Song Sparrow in full song was seen by the author on June 10 along the new road south of the reservoir. It apparently moved on for it was not heard again although we were often in this same area.

It might be well to record here, also, a Philadelphia Vireo (*Vireo philadelphicus*) seen June 29, 1934, at the edge of timberline just south of the reservoir and not previously reported.

The occurrence of these species that are common a few hundred miles to the south may have no special significance at this time. Possibly, however, they are another indication of a widespread movement of southern forms northward that seems to be occurring farther south in eastern United States and southern Canada. Cardinals, Carolina Wrens, Orchard Orioles, and Tufted Titmice, for example, seem to have increased considerably in central New York and southern Ontario in the last ten years. The occurrence of the Starlings is, of course, merely a part of that phenomenal extension of range that has been taking place during the past twenty years. This is probably the farthest north they have been recorded in North America and it bodes ill for the few Flickers that manage to excavate their nesting cavities at this northern latitude.

Of the eighty-two species observed, nests were found of 38 and it was interesting to discover certain nests on the same spots where they had been observed and photographed ten years before. This was to be expected on the Arctic Tern islands but it was a surprise to find the Arctic Loon's eggs within a few feet of the pegs that staked out the photographic blind of the previous trip; to find the lone Herring Gull's nest of the reservoir area still on the same large boulder and to observe the same stretches of tundra moss supporting Golden Plovers in about the same spots. Apparently conditions are so nearly static in this near-arctic environment that the passage of ten years

means little. Such changes in the bird life as were noted, therefore, are probably the result of changes elsewhere. The pronounced increase in Hudsonian Curlews and Dowitchers and the slight increase in Hudsonian Godwits could well be explained on the basis of the protection which they have been receiving farther south in recent years.

No effort will be made to list all the birds observed. Only those whose status seems to have changed or whose rarity makes them worthy of mention, will be included.

HORNED GREBE, *Colymbus auritus* Linnaeus.—Two nests of this more southern species were found in the grassy sloughs on either side of the road running from the reservoir to the airport.

PIED-BILLED GREBE, *Podilymbus podiceps* (Linnaeus).—One bird was seen and frequently heard calling in the same slough with the Horned Grebe south of the road.

CANADA GOOSE, *Branta canadensis* (Linnaeus).—Six nests were found and other pairs noted indicative of quite an increase in the nesting population.

BLUE-WINGED TEAL, *Anas discors* (Linnaeus).—A female of this species being tormented by five male Green-winged Teals was observed south of the reservoir. It took refuge under the roots of a dead spruce standing at the edge of a ditch and flushed from nearly under foot.

GOLDEN-EYE, *Glaucionetta clangula* (Linnaeus).—A female of this species was seen on June 16 circling around the town-site as though it were inspecting the various chimneys as possible nesting sites. It was later seen several times on the town-site slough.

WHITE-WINGED SCOTER, *Melanitta fusca deglandi* (Bonaparte).—Several pairs sat around together on Lake Isabelle during the latter part of June as though nesting, and one nest with six fresh eggs was found on June 27 on one of the tern islands. This seems to be the first definite nesting record for the area. The same small island had a nest of the Red-breasted Merganser containing thirteen eggs, one of an Old Squaw with seven eggs and an Arctic Loon's nest with one egg. The status of the other waterfowl seemed unchanged from that reported by Taverner and Sutton.

WILLOW PTARMIGAN, *Lagopus lagopus* (Linnaeus).—This species seemed notably scarcer in 1944 than it was in 1934 which was one of its peak years. Only two nests were found and one other brood of young seen. Not more than ten males were observed during the three-weeks period.

SANDHILL CRANE, *Grus canadensis* (Linnaeus).—A single bird was observed several times between June 21 and 24 a mile south of the reservoir, and once a pair was seen by David Allen but no nest was found.

KILLDEER, *Charadrius vociferus* (Linnaeus).—This species apparently has increased, for it could no longer be considered "uncommon." Five or six pairs were observed.

HUDSONIAN CURLEW, *Numenius phaeopus hudsonicus* Latham.—This species was reported as common by Taverner and Sutton but it was definitely more numerous in 1944 than in 1934. We estimated that there was at least one pair for every quarter mile of tundra. One could not leave the territory of one pair without immediately being scolded by the next ones.

SPOTTED SANDPIPER, *Actitis macularia* (Linnaeus).—Several pairs were noted around the town-site slough and the reservoir area—a noticable increase over 1934.

DOWITCHER, *Limnodromus griseus* (Gmelin).—This species seems to have increased considerably, especially about the grassy slough south of the road from the reservoir

to the airport, where perhaps ten pairs were nesting although only three nests were found—June 12, June 14, and June 20.

STILT SANDPIPER, *Micropalama himantopus* (Bonaparte).—Taverner and Sutton reported this as one of the commonest of the breeding shorebirds, but in 1944 it was about eighth on the list and we found only four nests. In the order of their abundance in 1944, I should list the breeding shorebirds about as follows: 1, Semipalmated Sandpiper; 2, Least Sandpiper; 3, Semipalmated Plover; 4, Hudsonian Curlew; 5, Northern Phalarope; 6, Lesser Yellow-legs; 7, Wilson's Snipe; 8, Stilt Sandpiper; 9, Red-backed Sandpiper; 10, Dowitcher; 11, Golden Plover; 12, Killdeer; 13, Spotted Sandpiper; 14, Hudsonian Godwit.

TREE SWALLOW, *Iridoprocne bicolor* (Vieillot).—At least two pairs nested on the town-site, one in a bird house, and they were occasionally noted elsewhere. This is possibly a slight increase.

AMERICAN ROBIN, *Turdus migratorius* Linnaeus.—This species seemed definitely to have increased since 1934, and many nests were found in the low spruces at timberline as well as about the town-site and the airport.

NORTHERN SHRIKE, *Lanius excubitor borealis* Vieillot.—David found a nest with well-fledged young in the top of a spruce, June 8. Later, at least four other family parties were observed, an apparent increase over previous records and my own 1934 observations when none was seen.

WESTERN MEADOWLARK, *Sturnella neglecta* (Bonaparte).—On June 7 and 8 a single male of this species was in full song near this town-site slough but was not seen nor heard later.

COMMON REDPOLL, *Acanthis flammea flammea* (Linnaeus).—This species seemed much less common than in 1934, and although it was seen nearly every day, only two nests were found.

TREE SPARROW, *Spizella arborea* (Wilson).—This species, likewise, seemed much less common than in 1934, especially around the town-site where it was seldom seen.

HARRIS'S SPARROW, *Zonotrichia querula* (Nuttall).—This species seemed somewhat less common than in 1934, although it was present in all suitable habitats. Only four nests were found.

LAPLAND LONGSPUR, *Calcarius lapponicus* (Linnaeus).—This species, while still fairly common, had dropped considerably in abundance, while the Smith's Longspur had increased, until in many places on the tundra remote from the town-site, the Smith's Longspur was the more common species. This was not the case in 1934 when the Lapland Longspur was abundant everywhere.

In conclusion, may I express my appreciation to Major Sam Wilkins, of the U. S. Army, who provided us with the freedom of the restricted area for our studies at a time when even the presence of an airport at Churchill was held secret. By the time this note is published, its presence and the part the U. S. Army had in developing it will be common knowledge. May we hope that the continued presence of the airport will have no greater effect on the bird life of this most interesting region than did its inception and development. May it, indeed, become a stepping-stone for naturalists who wish to carry on studies of the bird life still farther north about the airports of real arctic America.

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GENERAL NOTES

Flight speed of the Old-squaw.—On May 11, 1935, Frank Beldan and the writer timed two Old-squaws (*Clangula hyemalis*) as they flew from the north to the south end of the 2400-foot cut between Toronto Bay and Lake Ontario. In both cases the time was 26 seconds. This would give an average speed, over the 2400 feet, of 63 M. P. H. In this case both observers were stationed at the north end of the cut and on the east side of it. We could tell when the ducks passed our end of the cut, but had to guess when they passed the south end. We believe that the guess was fairly accurate, however, as the ducks kept close to the west wall of the cut and we followed them with a 47X telescope.

Several later attempts were made to obtain more accurate data and on April 26, 1936, we again succeeded in being at the cut at the time the Old-squaws were flying through it. This time Frank Beldan was stationed at the north end of the cut with field glasses while the writer was stationed at the south end with the telescope. When Frank saw a group of Old-squaws approaching his end of the gap he raised one arm as a warning; as soon as they passed the north end of the cut he raised both arms and the stop watch was started. The writer then searched for the group of approaching ducks with field glasses and stopped the watch when they passed the south end of the cut. The watch was started and stopped when the first duck in each group passed the ends of the cut. Some groups flew much faster than others, but the individuals in any given group kept very well together. None of the ducks appeared to be doing its best; birds toward the rear of a group would quite often put on a spurt and gain the leadership of their group without any apparent effort; and in the space of 100 feet such a spurt might carry a duck from the rear to the lead of a ten-foot group of the Old-squaws. The strength of the breeze did not seem to affect their speed very much, as some of the slowest records were made when the wind was strongest.

The observations were made between 7:00 and 8:15 P. M. The official wind velocity at 8:00 P. M. for Toronto was 11 M. P. H. from the northwest. This official reading was made in a different part of the city, and is at best just an indication of the average wind prevailing at the place where it was observed for the previous 20 or 30 minutes. Quite considerable variations in the strength of the wind were noted while the ducks were flying through. However, we had no means of measuring these wind fluctuations and so have used the official wind in calculating the average air speed below. The wind was so close to being a true tail wind that no allowance has been made for the slight angle between the average wind direction and the direction of flight of the Old-squaws. The seventh group timed swerved to the east when part way through the cut, hesitated, and then came on through. No allowance was made for this hesitation in computing the average. It must be remembered that the times given are the intervals elapsed between the time that the first bird in the groups passed the north end of the cut until the first bird in the group (but not likely the same individual) passed the south end of the cut. It was quite impossible to time any given individual in the rapidly-shifting groups. The average, then, will be the average speed for the 12 groups. Some idea of the size of the groups will be gained by noting the counts made for the last five groups timed.

Group No.	No. in the Group	Time to fly 2400 ft.	Ground Speed
1	—	25.2 secs.	64.8 M.P.H.
2	—	26.0	62.9
3	—	22.5	72.5
4	—	29.0	56.2
5	—	25.2	64.8
6	—	26.8	60.9
7	—	29.6	55.2
8	2	29.6	55.2
9	11	26.5	61.5
10	20	24.0	68.0
11	7	26.0	62.9
12	3	30.4	53.9
Average		26.7	61.5 M.P.H.
Average wind speed (a tail wind)			11.0 M.P.H.
Average air speed			50.5 M.P.H.

J. Murray Speirs, *92 McIntyre St. West, North Bay, Ontario.*

Prating for Passenger Pigeons.—Thoreau's journal records many observations on the Passenger Pigeon and the means used in Concord for catching it, and these observations, all of which are gathered in his 'Notes on New England Birds' (1910), later reissued as 'Thoreau's Bird-Lore,' include several references to the call-notes of the species, especially the *prate*, or *prating*. An imitation of this note was used for luring the birds to the net, and the journal entry for March 29, 1853, tells us that one Dugan had seen two pigeons that day and had 'prated' for them. As the dictionaries appear to have overlooked this use of the word 'prate' and as I do not find it in any of the ornithological literature I have at hand, it may be worth while to put on record what the late Fletcher Osgood, of Chelsea, Massachusetts, an expert in phonetics who was also something of an ornithologist, told me about it some twenty years ago. "Many and many a time," he wrote, "have I heard my father *prate* for pigeons. Father was born and brought up in Westford, Mass., [a town near Concord] and knew all about pigeon netting and shooting . . . Wild pigeon prating consisted of voice delivered through *tightly* approximated lips, with a buzz or vibration of those lips, in two somewhat prolonged, high-pitched monotones (a very brief interval of silence between the monotones, of course) followed by a somewhat more prolonged monotone on a decidedly higher pitch, this immediately followed by two scale-descending monotones, the descent approximately an octave or more, each descending monotone *briefly* uttered, no prolongation. No doubt this formula was individually varied; at times, I think, rising inflections, still high-pitched but of short range, were substituted for the first two monotones. The formula as given seems at least to be an approximation to orthodox usage in old Westford."

This 'prating,' whether called by that name or not, was probably much the same method of luring the pigeons as that used by Herman Behr ('Cassinia,' 1911, pp. 24–27, quoted by Bent in his 'Life Histories') and described by H. T. Blodgett (Mershon's 'Passenger Pigeon'). The art is doubtless as completely extinct now as the Passenger Pigeon itself.—Francis H. Allen, *West Roxbury, Massachusetts.*

An unusual feeding habit of the Black Vulture.—During the past winter, grazing conditions were unusually good in southwestern Louisiana and, as most of the

old stock had been sold from the cattle ranges of Avery Island and adjacent prairies, there were very few animals that died during the winter. Therefore, the food of the Black Vulture, *Coragyps atratus* (Meyer) was scarce.

I maintain, at Avery Island, two deer parks of about thirty acres each, and a thirty-five acre breeding ground for nutria (*Myocastor bonariensis*). I fed both the deer and nutria chopped sweet potatoes during the past winter. The feed was usually put into the feeding troughs in the early morning. The man in charge of the feeding reported that a number of Black Vultures came to each of the feeding places every morning and ate up quite a quantity of the chopped-up sweet potatoes. This feeding habit of the vultures was so unusual that it was difficult for me to believe, so I spent several mornings watching the troughs. I found that the vultures gathered at the feeding places before the food was put out and, as soon as it was spread in the troughs for both the nutria and the deer, the vultures would alight on the troughs and rapidly eat a large portion of it. I did not pay much attention to this depredation by the vultures until the man in charge of the feeding advised me that the vultures were coming in such numbers each morning that the deer and nutria were getting only a small portion of the food put out for them. I then had the feeding time changed from morning to after sundown, and this change in time, to a large extent, overcame the trouble. E. A. McILHENNY, *Avery Island, Louisiana.*

A change of breeding season by Australian gulls.—In the year 1922, the National Zoological Park added to its collection of birds several specimens of the Australian Silver Gull (*Larus novae-hollandiae*). These birds nested in November for two seasons, then adapted their breeding time to our spring and early summer. This northern-hemisphere nesting behavior of the birds continued regularly until this year, 1943. The descendants of the original stock have now reverted to the first nesting season in the park, which corresponds to the dates in their normal range in the southern hemisphere. During a snowstorm in December, the eggs in two nests hatched and it became necessary to remove the birds and hand-feed them in the heated bird house.

Just what caused these birds to change their breeding season again after a continuous period of about twenty-two years of spring reproduction to the original winter courtship and nest-building, is a question that I am unable to answer.—MALCOLM DAVIS, *National Zoological Park, Washington, D. C.*

Catesby's tropic-bird.—Of the tropic-birds included in the A. O. U. Check-List (1931), one, the Red-tailed (*Phaëthon rubricauda rothschildi*), is recorded as accidental near Guadalupe Island, Lower California. Two chiefly white-tailed species are recorded from Atlantic Coast waters, one the Red-billed (*Phaëthon aethereus*), as a breeder in the Lesser Antilles, casual in Jamaica and Bermuda, and accidental off Newfoundland, and the other, the Yellow-billed (*Phaëthon lepturus catesbyi*), as a breeder in Bermuda and West Indies and accidental in Florida, South Carolina, New York, and off Nova Scotia. There has been more or less confusion of the last two forms, for one reason because the color of the bill is not distinctive [Plath, Ibis, (10) 2: 554, 1914; Wetmore, Proc. N. Y. Acad. Sci., 9 (3): 278, 1927], although it has long been indicated as diagnostic in the vernacular names.

In this discussion the forms will be referred to in accordance with their most obvious visual characters, as the barred-backed (Red-billed) and white-backed (Yellow-billed) species. Linnaeus (Syst. Nat., ed. 10, 1: 134, 1758) applied the name *aethereus* to the former but his citations included apparently all of the tropic

birds recorded from the world at that time. His references number eight, and of these we may ignore half, namely those to Aldrovandus, Edwards, Sloane, and Kalm as, for lack of description or other reason, the birds referred to are not specifically identifiable. All of the others describe the back of the bird as white with transverse wavy black lines. There are only two known species of tropic-birds having this character: *aethereus* L., and *indicus* Hume. The latter species need not be further considered here. Peters ('Birds of the World,' 1: 78, 1931) places *indicus* as one of four subspecies of *aethereus*. Linnaeus's first reference is to Catesby—"Car. 3, p. 14, t. 14"—and his description of the critical character is: "alba supra lineis nigricantibus undulata tota." This is close to a literal translation of Catesby's words: "White, except the back which is variegated with curved lines of black."

How it was ever concluded that Catesby's tropic-bird was the white-backed species is, therefore, a mystery. Typical of the confusion is Coues's treatment (Key N. A. birds, ed. 5: 972, 1903), in which he calls the barred-backed species, Catesby's Tropic Bird, yet in his account of the white-backed species says: "This is the original Tropick Bird of Catesby, 1743, pl. 14." The reason for this conclusion in disregard of the principal fact involved probably was the assumption that Catesby's bird was from the Bermudas where the white-backed species is a common breeder. But Catesby does not say that the material from which his description was made was of Bermudan origin. He merely says, as of a past occurrence, that he had shot tropic birds (of which apparently he thought there was only a single species) "there at the time of their breeding. . . . They breed also on some little islands at the east end of Porto-Rico" (Carolina, 2, Appendix: 14, 1743).

So far as locality is concerned, even if Catesby's bird was from the Bermudas, it might have been a straggler of the barred-backed form such as subsequently has been recorded from those islands (A. O. U. Check-List, 4th ed.: 17, 1931). His illustration (Appendix, Pl. 14), Mathews's compliment to the contrary notwithstanding, is not identifiable. It does not show a white back "variegated with curved lines of black," but it is also far from white, better described as fulvous in the copy now accessible to me. In the Edwards edition of Catesby, the figure has been altered so as to correspond more closely with the description but still does not show the back "variegated with curved lines of black." However, interest in this edition is merely academic; the original remains the decisive reference. Moreover, regardless of what a plate might show, the plain words of the description can not be ignored.

Another element—size—may be involved, as Osbeck (Iter, 291; known to me in the German translation of J. G. Georgi, 1765), one of the authors cited by Linnaeus, said his bird was the size of a duck, while Catesby compared his in that respect to a partridge. There is nothing necessarily distinctive in these references, and the color description remains the only tangible diagnostic element in these early accounts.

The evidence, therefore, seems clearly to indicate that Catesby's Tropick-bird is that described by Linnaeus as *aethereus* of which it was a partial basis. Indeed, with a first species rule, it would have been the governing criterion of the name. Thus it appears any name based solely upon Catesby's description must be a synonym of *aethereus*. That includes *Phaëthon catesbyi* Brandt which Mathews [Auk, 32 (3): 195–197, 1915] proposed to revive for the white-backed species. Brandt put a question mark after the name, showing that he was not formally pro-

posing it (Monogr. Phaëthon: 270, 1840), but ignoring that, his description is merely a translation of Catesby's, including the sentence, "Color generalis albus, dorso transversim nigro fasciolato."

In view of the record as here reviewed, it seems necessary to revert to the usage of the third edition of the A. O. U. Check-List (1910, p. 59) and use Ogilvie-Grant's name *Phaëthon americanus* (*Phaëton americanus*, Bull. British Orn. Club, 49: xxiv, Dec., 1897) for the white-backed bird. As this form is considered a subspecies in the *lepturus* complex (Oberholser, Auk, 36: 556, 1919; Peters, Birds of the World, 1: 79, 1931), the name should be *Phaëthon lepturus americanus* Ogilvie-Grant. This author, in his revision (Cat. Birds British Mus., 26: 456, 1898), while correctly citing *Phaëthon catesbyi* Brandt as a synonym of *P. aethereus*, makes the first reference under *P. americanus*, the Tropick Bird of Catesby, thus giving further evidence of the strange confusion that has prevailed with respect to the names of the western Atlantic tropic birds. Despite this slip, Ogilvie-Grant described the white-backed species (by comparing it with *flavirostris* = *lepturus*) and gave it its only unshared name.—W. L. McAtee, *Fish and Wildlife Service, Chicago, Illinois.*

The type of *Telespiza ultima* Bryan.—In 'The Auk,' 34: 70–72, 1917, the late William A. Bryan named and described *Telespiza ultima* from Nihoa Island, Hawaii. The type series consisted of five specimens collected by Lieut. W. H. Munter, February 12, 1916. The holotype and three paratypes were skins made from formalin specimens; the fifth was left in formalin.

Among a number of Mr. Bryan's birdskins recently donated by Mrs. Bryan to the Los Angeles County Museum are the four above mentioned. The holotype is now no. 20243 and the three paratypes are nos. 20244–5–6 in our collection.—G. Willett, *Los Angeles County Museum, Los Angeles, California.*

The correct name of the Fijian Mountain Lorikeet.—Flights of this little lory appeared in the summer of 1875 in different parts of the Fiji Islands and specimens collected by C. Pearce, A. Boyd, Th. Kleinschmidt, and A. L. Layard came into the possession of three bird taxonomists. All three described the species as new, but Finsch, learning of an earlier name for the species, withdrew his own name at the last minute (Journ. Mus. Godeffroy, 12: 3–4, 1876). The species is now known under the name *Vini aureicinctus* (Layard) [Ann. Mag. Nat. Hist., (4) 16: 344, Nov., 1875]. Actually the species had already been described four months earlier by Ramsay under the name *Trichoglossus amabilis*. Ramsay read a description of this species at a meeting of the Linnaean Society of New South Wales on July 26, 1875. However, the Proceedings of the Society, which contain the report of this meeting, were not published until February, 1876. Knowing the tardiness of this publication, Ramsay took steps to insure the priority of his description. Since at that date no frequently issued scientific journal was available in Australia, he published a complete, detailed, technical description of *amabilis* in a daily newspaper, the Sydney Morning Herald of July 28, 1875. Furthermore, in order to make sure that this publication would not be overlooked, he called attention to it in the Proc. Linn. Soc. N. S. W., 1: 74. Mr. K. A. Hindwood had the great kindness to look up the files of the Sydney Morning Herald and report to me that no. 11604 (of July 28, 1875) of this paper contains on p. 9 "a very complete technical description of both male and female [of *amabilis*], together with measurements and some general remarks. The actual descriptions of both male and female take up about 50 lines single column in the newspaper."

There is no doubt that a newspaper is not the best medium for the publication of new names. However, Ramsay had apparently no available channel for publication and Peters and other authors have accepted other newspaper names of Ramsay. The International Rules contain nothing that would invalidate Ramsay's name. We must therefore accept *amabilis* Ramsay as an earlier name for *aureicinctus* Layard.—E. MAYR, *American Museum of Natural History, New York, N. Y.*

Unusual "pigeonries" of the domestic pigeon.—While collecting data for a life history study of *Falco mexicanus* Schlegel, "street" pigeons or hybrids of *Columba livia, C. affinis* and possibly other species of the genus *Columba,* were found in an apparent reversion to a wild state.

A number of colonies have been observed in recent years in the bluff and cliff formations in southeastern Wyoming and eastern Colorado; these "pigeonries" often are situated on the open plain, many miles from the nearest human habitation, and the birds to all appearances subsist independent of man.

One of the largest colonies located was on Bear Mountain, Goshen County, Wyoming, where eighteen adults were counted. Two nests were found containing two eggs each. These nests were composed of small sticks and twigs placed well back in small potholes in the cliff. These potholes had openings of about six to eight inches and were slightly over a foot in depth. The accumulations of fecal matter indicated that similar potholes were used as roosts.

In northeastern Colorado a pair of blue checker pigeons with white primary feathers was observed in the company of a male *Falco sparverius sparverius.* All three landed on a ledge and relationships were on an apparently harmonious basis. The cock pigeon was driving the hen to nest and the Sparrow Hawk followed them from ledge to ledge. The eyries of *Buteo regalis, Aquila chrysaetos canadensis, Falco mexicanus,* and *Falco sparverius sparverius* have been located within the immediate vicinity of these colonies.

The observations have been confirmed by Harold M. Webster (personal communication), Tucson, Arizona. "I have found wild pigeons in several sections of cliff living right along with nesting falcons and an eagle in one case. They are especially common in the Garden of the Gods, the Larkspur area, the Park of the Red Rocks, and in South Boulder Canyon (Colorado). It is not unusual to see one taken by a falcon, but as you know the falcons prefer to eat ground mammals instead. The pigeons I have seen in the cliffs adjacent to falcon eyries were all well blooded birds and showed remarkable ability in keeping ahead of the falcons. In flying, these pigeons came in like comets, not giving the falcons much opportunity to stoop at them."

There is yet, however, little available information as to the habits of these pigeons, or even as to whether the colonies are permanently established.—RALPH B. WILLIAMS, *Wyoming Public Health Laboratory, Cheyenne, Wyoming.*

Aircraft collision with a goldfinch.—At about 4:30 on August 11, 1944, while in the vicinity of Dayton, Ohio, the ship that I was flying, a Douglas transport weighing twelve and a half tons, struck a bird with the windshield which was cracked badly. We were descending at the time and our speed through the air was between 170 and 180 miles per hour after corrections for temperature and altitude errors. The indicated altitude at the time of the impact was between 1,000 and 1,200 feet above the surface of the ground. The surface elevation in that area is about 1,000 feet above sea level.

Upon arrival at the airport, examination revealed that some of the bird was

still on the windshield, having been forced behind the windshield wiper. The feathers remaining on the windshield were carefully removed and wrapped and were later sent to the American Museum of Natural History where they were identified as those of the American Goldfinch. The average weight of this species is approximately 12.5 grams.

I am informed by the American Museum of Natural History that these birds are relatively high flyers and that their migrations also take place at night. I might point out that it was just beginning to get light at 4:30 on this particular morning. It is surprising that this species should have been migrating at such an early date as most American Goldfinches begin their migrations during the latter part of September.

An interesting sidelight was brought out by computing the impact. Due to the lack of information necessary in accurately computing the foot-poundage of the impact, we made computations based on assumptions as to the thickness of the remains of the bird and the area that they covered upon impact, and arrived at a figure of 100 lbs. pressure in the area of impact.

I want to thank Dr. Robert Cushman Murphy of the American Museum of Natural History for his kindness and help in preparing this note.—CAPT. V. H. BROWN, *American Airlines, Memphis, Tennessee.*

Aortic rupture in Field Sparrow due to fright.—On June 6, 1943, I found the nest of a Field Sparrow (*Spizella pusilla pusilla*) on a one-hundred-acre tract of land in Pennfield Township, Calhoun County, Michigan, where I have been making an extensive study of the species. The nest was placed underneath a tuft of grass on a side hill and contained four eggs of normal size and weight. The female was observed to be unbanded, so early on the morning of June 7 a small hair-net was placed to one side of the nest and the female Field Sparrow frightened from the nest into the net in a short time. This has proved a very effective means of capturing Field Sparrows during the six summers that I have studied them, and over 200 adults have been thus captured for banding.

Although there is considerable variation in the behavior of individual birds of one species, due to fright, just as there is with humans, I have never encountered a bird quite as frightened as was this particular Field Sparrow when I removed her from the net and banded her. She was so frightened that she breathed in gasps, similar to the panting of a dog. Immediately after banding her I opened my hand and released her, but she fluttered to the ground. I picked her up and again released her, but she dropped to the ground once more and when I picked her up for the third time I found that she was dead.

Dissection revealed a clot in the region of the heart about 5 or 6 mm. in diameter, and on closer examination it was found that the wall of the lower side of the ascending aorta had ruptured about 2 mm. from the heart. This rupture was about 1 mm. wide, and even though it might have been produced by an aortic wall weaker than normal, it was, of course, caused by the fright produced when I captured the bird.—LAWRENCE H. WALKINSHAW, *Battle Creek, Michigan.*

The Robin does not change its tail spots.—During banding activities, a study was made of the white tail spots of 162 trapped Eastern Robins (*Turdus m. migratorius*) from 1938 to 1943. These rectricial spots varied greatly in size, shape, and the number of feathers involved. One adult Robin had no indication whatever of white on any feather and one had only one millimeter of white showing

on the outer feather; 56 birds had the white only on the outer feather, 71 on the outer two, 28 on three feathers, three on the outer four rectrices, and three on the outer five. In none was the white mark on the first rectrix over, or much over, one centimeter in length. The involvement of the adjoining feathers decreased markedly. Exact sketches were made of the size, shape, and amount of the white areas in all tail feathers of the 162 Robins. There were no two alike in the proximal outline of the main spot. Only eight of these Robins returned to the traps in subsequent years, a return percentage of five, about equal to the general average return of Robins banded at all ages.

One Robin, 39-250343, had the basal three centimeters of all rectrices white—the only such specimen seen. Another, trapped in 1942 and again in 1943, had gray tips to the outer feather, no white on any. Two Robins, trapped, sketched, and banded in 1940 and retrapped in 1941 and 1943, gave excellent opportunity to compare the configuration and extent of the white markings, and three others which made I-returns and II-returns, in each set, also helped in the study. A careful comparison of the drawings, and some collected feathers, showed that by subsequent molts there was no increase in the number of feathers involved in any individual, nor was there any appreciable difference in the shape or in the proximal outline of the white areas. These rectricial white spots in the Eastern Robin are therefore constant in amount, and appear in the first feathers developed.—HAROLD B. WOOD, *3016 North Second St., Harrisburg, Pennsylvania.*

Extraordinary Fatality to a Blue-winged Teal.—On March 12, 1944, while looking at water birds on a small pond south of San Antonio, Texas, I noticed a duck hanging from the telephone wires along the highway. Examination showed that the bird, a female Blue-winged Teal (*Anas discors*), had evidently flown through the wires at high speed with its beak open. The open beak had scooped in two wires, and the velocity had been sufficient to split the corners of the teal's mouth open and drive the wires back to the base of the skull. The victim was left hanging from the two wires which were forced into its skull.—MAJOR CLIFFORD PANGBURN, *Randolph Field, Texas.*

The Woodcock at San Antonio, Texas.—On March 5, 1944, I was watching a flock of Wilson's Snipe (*Capella delicata*) which were feeding at the edge of a small pond just south of San Antonio. A Woodcock (*Philohela minor*) suddenly appeared from behind a grass clump. It was not more than 50 yards distant in full moonlight, and was easily identifiable through my 8X binoculars.—MAJOR CLIFFORD PANGBURN, *Randolph Field, Texas.*

Great Black-backed Gull kills adult Black Duck.—It has long been the conviction of some of the old-time duck hunters at Newburyport, Massachusetts, that the Great Black-backed Gull will attack and kill adult Black Ducks. This has seemed incredible, knowing the prowess and swift flight of the Black Duck. Bent, in his 'Life Histories of North American Gulls and Terns' (1921), does not mention its taking live waterfowl other than young eiders on the breeding grounds. Forbush, in his 'Birds of Massachusetts and other New England States' (1929), reports from his own observations and those of others that the Black-back kills Dovekies and other small birds, young ducklings, and American Coots, and has been known to carry off full-grown scoters.

On numerous occasions Black-backs have been observed by myself and others molesting Black Ducks, but only recently did I witness the complete performance of attacking and killing. On January 21, 1943, C. H. Richardson, of Newburyport, reported seeing a Black-backed Gull feeding on a Black Duck in Newburyport Harbor. On February 17, 1943, I witnessed an adult Black-back commencing to feed on a freshly killed Black Duck at the mouth of the Merrimac River. Both duck and gull were seen floating down the channel toward the sea. The duck was on its back when first seen and the gull was commencing to pull out the breast feathers. On April 28, 1944, Kenneth Aylward and myself witnessed a group of Black-backs single out and kill a Black Duck from a flock of several hundred birds at Newburyport. The episode may be of sufficient interest to warrant some detail.

It was a clear day with a strong northeast wind, and the tide was nearly out, exposing extensive areas of mud flats in the harbor area. At approximately 10 A. M., several Black-backed Gulls were observed chasing and swooping at various Black Ducks wherever there were sizable concentration. Suddenly an adult gull struck a Black Duck and apparently injured it to the extent that it never attempted to fly from its attackers. In subsequently trying to elude the gulls, the duck would swim away or merely flap along the water surface. For twenty-five minutes to a half hour the original attacker and five to seven other Black-backs (adults and immatures) continually harassed the duck. On at least four occasions, both adult and immature gulls were observed to swoop down on the duck, seize it by the neck, lift it several feet off the water, and carry it a few yards before dropping the struggling bird. The original adult attacker, however, was more persistent in pursuing the duck, striking the bird with its heavy bill and apparently grasping it firmly by the back over the lungs. The strong hooked bill of the gull may have pierced the duck's body at this vulnerable point, causing damage to the internal organs.

Within half an hour, the Black Duck was dead and the adult gull began to feed. Seven other Black-backs, both adults and immatures, were present and had to be driven off on numerous occasions by the old gull. The adult gull fed voraciously for two hours until 12:25 P. M. It was then that a near-by immature Black-back was permitted to feed on the remains.

The duck carcass was immediately retrieved. Most of the meat of the breast and legs and the internal organs, with the exception of the heart and portions of lungs, were consumed. The head was not eaten. The bird was a male Black Duck and the remains weighed 1½ pounds. This type of duck averages close to 3 pounds at Newburyport so that the gull consumed about 1½ pounds during the single feeding.

The duck was in apparent good health although several primary feathers were missing from the right wing when the partially eaten bird was examined. These feathers appeared to have been recently lost, but it is not definitely known whether the gulls were responsible.

It has been observed that when a Black-backed Gull swoops low and surprises a Black Duck, the latter skulks or 'spreads out' on the water, thus making an easy prey for the powerful gull.—C. E. Addy, *Leader, Federal Aid Project 4R, Massachusetts Department of Conservation.*

The molt of the Emperor Penguin. (*Plate 8.*)—The change of plumage through molt—the shedding of the old, weather-beaten feathers and their replacement by an entirely new suit—occurs in some birds once a year, although in others, at least in some parts of the plumage, it takes place twice a year or even three times. The growing of new feathers is a most severe strain upon the individual, at times more detrimental than the temporary absence of food.

The various degrees of molt are many. Whereas the molt is sometimes briefly described as a feather-shedding phenomenon with the growing of new feathers, in some forms it includes a general renewal of other parts of the integument. This occurs in some species of the Tetraonidae where the long winter claws are shed or worn off as spring arrives. The North American White Pelican sheds the horny, ridge-like projection on the beak that it carries during the breeding season, and the puffin molts its horny beak-sheath.

The species of the family of penguins, Spheniscidae, undergo a most peculiar molt. The scaly feathers are not shed in special order but come off in flakes. The National Zoological Park, Washington, D. C., has in its collection of living birds three Emperor Penguins (*Aptenodytes forsteri*) collected by the U. S. Antarctic Service Expedition of 1939–1941. I was a member of this expedition and collected and observed the Emperor Penguin in Antarctica and have supervised the care of the species in captivity.

The first of these penguins obtained by the expedition was observed through binoculars, and appeared like a small man dressed in black, standing amidst a snowstorm. I left the ship and went out on the ice with three members of the expedition picking my way through pressure ice toward the bird, which proved to be in full molt. It offered little resistance as I put a rope around it and stuffed it into a bag that I then shouldered and carried back to the ship. I relate this story of the capture to indicate that, while molting, the Emperor Penguin takes little interest in what is going on around it, does not swim, and remains on the ice.

For a period of twelve months I have recorded the molts of our three Emperor Penguins in captivity. Birds A and B, in January, underwent a partial molt which lasted sixteen days. Bird C, in February, also went into a partial molt terminating in twenty-five days. In March, all three birds went into a complete or full molt that lasted thirty-two days. Bird B, in August, underwent a partial molt that ended in twenty-two days. The horny covering of the lower mandible was shed during this molt, revealing a new dark yellow sheath. In the course of these molts the birds refused to eat their full ration of fish during the latter stages of the transformation, the stage when the new feathers are in the process of forming. Other activities, such as that of pacing the cage in single file and occasionally swimming, largely ceased.

The shedding of feathers begins on the postero-ventral portion of the body, and progresses in an irregular manner over the body of the bird. As is shown in Plate 8, the dorso-anterior regions hold their feathers until the last. During the full molt it is possible to catch the birds and pull the feathers out in large handfuls. This 'picking alive' hastens the growing of the new coat of feathers, and is desirable if an individual appears unable to complete the molt and refuses to resume feeding after a reasonable time of fasting.—MALCOLM DAVIS, *National Zoological Park, Washington, D. C.* [Published with the permission of the Secretary of the Smithsonian Institution, Washington, D. C.]

KIMBALL.—LOUISIANA HERON IN VIRGINIA IN DECEMBER.

DAVIS.—THE MOLT OF THE EMPEROR PENGUIN.

Louisiana Heron in Virginia in December. (*Plate 8.*)—Wachapreague, Virginia, is situated on the ocean side of the peninsula about thirty miles north of Cape Charles village and forty miles north of Cape Charles Point. The bay is separated from the ocean by an island (Paramour Island, I believe?), its mainland side bordered by extensive marsh with deep tidal channels, most tenacious soft mud, and the marsh growth consisting entirely of what the natives call "wild oats," on which the ducks feed. The locality is interesting to a naturalist on account of being unspoiled, apparently on the borderline between north and deeper south.

On December 3, 1943, which was mild (65° F.) and calm with bright sunlight, a Louisiana Heron (*Hydranassa tricolor ruficollis*) was observed in the middle of the marsh at close range. It seemed in perfectly good condition, but was not at all wild, and, when flushed, returned to the same spot thrice. Photographs of it in flight were obtained which prove positive identifications. A single Boat-tailed Grackle (*Cassidix mexicanus major*) was also present, perched on a tall upright stake in the meadows.

When I was there again on January 7 and 8, 1944, winter had set in (28° F. and snow), and neither of these species was seen. However, a Greater Yellow-legs (*Totanus melanoleucus*) was observed, although this is a northerly locality for a wintering bird of this species.—Heathcote Kimball, *121 East 60th St., New York, New York.*

A Chimney Swift from Colombia.—Some months ago, Brother Nicéforo María of Bogotá, Colombia, submitted to me a small collection of birds from that country for identification. Included in the series was a specimen of the Chimney Swift (*Chaetura pelagica*), labeled as from Santa Rosa, north of Tunja, Colombia, May, 1931. The specimen had the wings clipped but was otherwise in excellent condition, and a notation on the label explained the imperfection by the statement: "Captured and spoiled by a boy."

This appeared undoubtedly to be the first example of the species to be secured anywhere in South America, but the lateness of the month recorded on the label—a date when the species should be back in the United States—led me to write to my correspondent to see if this might not be the date of his receipt of the bird and not that of actual collection. In reply, I was advised that the boy had obtained the bird in April, which would be a quite reasonable month in which the bird might still have been in winter quarters or at least on its way northward.

In the mean time, Mr. Frederick C. Lincoln had obtained positive evidence of the winter quarters of the species in the neighborhood of the Río Napo, in northeastern Perú, and was able to write the interesting account that appeared in 'The Auk' in October of last year (61: 605–609, 1944). Mr. Lincoln's data concern birds that were taken much later than the Colombian specimen now before me, but they have the honor of being recorded first. It is interesting to note that the Río Yanayacu, Perú, where the birds were discovered, New Haven, Connecticut, where one of the wintering birds had been banded, and Santa Rosa, Colombia, where the specimen now at hand was collected, are all close to the 73rd meridian west longitude. A bird traveling from New Haven to the Río Yanayacu by the most direct route would pass over the neighborhood of Santa Rosa.—John T. Zimmer, *American Museum of Natural History, New York, N. Y.*

Duck Hawk nesting in the Great Valley of Virginia.—Ten or more years ago, while making intensive botanical explorations of the mountains of Virginia, the writer located an eyrie of a pair of Duck Hawks (*Falco peregrinus anatum*) situ-

ated on a high mountain cliff overlooking the countryside. This cliff has since been visited practically every summer and it is known that these fine falcons continue to use this nesting site. The nest, near the 2500-foot contour and about 900 feet above the surrounding countryside, is very close to the dangerous, fragmenting overhang of the cliffs, and can be safely reached only by rope.

This eyrie appears to be a new record, and it seems best not to define the exact locality except to state that it is in northern Virginia, where several ranges of mountains occur.—H. A. ALLARD, *Washington, D. C.*

Brasher's Warbler in Texas.—On the morning of September 5, 1943, the writer had opportunity to observe carefully from all angles of view a Brasher's Warbler (*Basileuterus culicivorus*). The bird was discovered in the woods along the Fresnos Resaca about three miles south of Harlingen, Texas. While perched about three feet above the ground the bird picked at the feathers on its chest. During this action the feathers of the pileum were sufficiently ruffled to show the median stripe conspicuously. At this time it appeared somewhat orange-yellow, whereas from other angles it had appeared to be obscurely yellow. The dusky lateral crown stripes appeared to be considerably wider than the yellow median line but they were not wide enough to be observed from a straight side view. The head markings and the bright yellow under parts were taken to indicate the subspecies *brasherii*.

At first glance (from below and to one side) the bird was mistaken for a female Nashville Warbler, but almost instantly it was noted that the face was too light and the dusky stripe through the eye further disagreed; consequently, the bird was followed until excellent views of the crown were obtained which made identification certain.—L. IRBY DAVIS, *Harlingen, Texas.*

Yellow-green Vireo nesting in Cameron County, Texas.—Three singing Yellow-green Vireos (*Vireo flavoviridis*) were discovered by the writer in a tract of hackberry woods about thirteen miles southwest of Harlingen, Texas, on June 20, 1943. After long search, one female was found sitting on a nest which was about 18 feet up in a small tree. No other female was discovered in an hour-long search and no males were found outside the 100-yard triangular area occupied by these three. The close association of the three males suggested to the writer that they might have come into the area together with a wave of migrants and that only the single female accompanied them. Each male seemed to keep to a rather small area and chased either of the others if they came too close. The female gave the usual rattle while in irritated flight through the brush. No young were observed to leave the nest and it is thought likely that they were eaten by the colony of grackles that nested near-by. At least one male was still in the area the first week in August but none could be found on September 5 when the place was again visited. A long search at this time, however, disclosed two additional nests apparently built by these birds. They were of the same size and shape as the nest known to have been used by the species and were from 16 to 20 feet above the ground, which seemed entirely too high to indicate a White-eyed Vireo (the only other resident vireo). If these two other nests did belong to Yellow-green Vireos, they may perhaps have been built by the same female, although additional females could possibly have escaped detection when I was searching for them.—L. IRBY DAVIS, *Harlingen, Texas.*

The Phainopepla near San Antonio, Texas.—On April 9, 1944, we saw a Phainopepla (*Phainopepla nitens* subsp.) about half-way between the dam at Medina

Lake and Paradise Canyon. This is less than thirty miles in an airline from San Antonio.—Major Clifford H. Pangburn, *Randolph Field*, and Sergeant Joseph M. Heiser, Jr., *Brooke General Hospital, Texas.*

Arkansas Kingbird in Alabama.—On September 28, 1941, I collected an Arkansas Kingbird (*Tyrannus verticalis*) at Gulf Shores, Baldwin Co., Alabama. The bird was perched in a treetop overlooking the shore of the Gulf of Mexico. It appeared to be an immature female, and the identification was confirmed at Cornell University where the specimen now bears the number 11600 in the Fuertes Memorial Collection. Although I could find no previous records for the state of Alabama, it would be natural for the birds to pass through the state during their autumnal wanderings to Florida and other parts of the East Coast. It is probable that too few observers were in the area at that time of year to detect the species previously. —Lt. Gerald Rogers, *Oklahoma City, Oklahoma.*

Records of the European Widgeon on the east coast of Vancouver Island, British Columbia.—During over twenty years residence in the Comox District, I have been watching for the European Widgeon (*Mareca penelope*) among the flocks of Baldpates (*M. americana*) that migrate through the region every fall and spring, and that sometimes winter in some numbers. It is only quite recently that I have been fortunate to see examples, as follows: During the month of November, 1941, one at the mouth of the river near Courtenay and another at the mouth of Black Creek, some fifteen miles farther north. The same bird, or another, was seen at Black Creek the following month and at Courtenay, January 29, 1942. In January, 1943, one was shot at Comox. These were all adult males and therefore easily distinguished.

There is a decided difference in the calls of the two species; the note of the European bird is higher-pitched and not so drawn out. It was possible to get sufficiently near the flock, on one occasion, to make quite certain of this though I had noticed the difference before. By its call I am sure that there was a European Widgeon in a flock of Baldpates that were put up in the early fall of 1942, but the bird in question must have been either a female or an immature male as there certainly was not an adult male in the flock.

In view of the recent article by Dr. E. M. Hasbbrouck (The Auk, 61: 93–104, 1944), it seems desirable to add these records.—Theed Pearse, *Courtenay, Vancouver Island, British Columbia.*

Another breeding record of the Ring-necked Duck for the Province of Quebec, Canada.—On July 16, 1943, while exploring Lake St. Edmond, Stoneham, Quebec County, Quebec, I saw with binoculars what at first seemed to be Ring-necked Ducks (*Nyroca collaris*)—two pairs flying over and one female on the water with a brood of about a dozen young. Being unable at that time to confirm my identification by the capture of specimens, I returned on July 23 to the same lake, accompanied by Dr. Richard Bernard and H. E. Corbeil.

Lake St. Edmond is a small Laurentian lake, situated about 16 miles north of Quebec City. Large masses of aquatic plants—pondweeds, eel grasses, water shields, and pondlilies—are flourishing in the lake, and its marshy shores are covered with a heavy growth of rushes, sedges, and such vegetation.

On our second visit, when just nearing the lake we saw with binoculars at about 100 yards from us one adult female Ring-necked Duck escaping on the water with eleven downy young. Later, another brood was approached and an adult

female was taken with one downy young of about three to four days old. Those two specimens are now nos. 118 and 119 in the Quebec Zoological Garden's bird-skin collection.

On July 23, at least three broods of Ring-necked Ducks were seen on the lake, making a total of about thirty young.

Actually there are two other breeding records from Quebec known to the writer. One is from Rush Lake, Frontenac County (The Auk, 60: 600, 1943) and another from Messines, Gatineau County, known to the writer through personal correspondence with Dr. Ira N. Gabrielson. In a letter, Doctor Gabrielson states: "On July 4, 1941, I saw a female ring-necked duck with eight newly hatched young near Messines, Quebec."

Special acknowledgement is due to Dr. Harrison F. Lewis and to Mr. Howard L. Mendall for information concerning the status of the Ring-necked Duck in Quebec. The record of Lake St. Edmond constitutes as far as known the third authentic breeding record of the species in the Province of Quebec.—Raymond Cayouette, *Quebec Zoological Garden, Charlesbourg, Quebec.*

Red-eyed Vireo's incubation.—To the recent instance by Petrides (Auk, 61: 298, 1944) of a Red-eyed Vireo (*Vireo olivaceus*) beginning to incubate before the clutch was complete, I can add another. A nest found in Baltimore on July 9, 1943, held four eggs; single inspections daily then yielded this hatching record:

July 11—noon —4 eggs.
July 12—evening—1 young, 3 eggs.
July 13—evening—2 young, 2 eggs.
July 14—evening—3 young, 1 egg which proved to be infertile.

Incubation of this clutch must have begun with the laying of either the first or the second egg.—Hervey Brackbill, *3201 Carlisle Avenue, Baltimore 16, Maryland.*

Leach's Petrel in Florida.—On May 12, 1944, the first recorded Florida specimen of Leach's Petrel (*Oceanodroma leucorhoa leucorhoa*) was found in the edge of the surf at Daytona Beach, Florida. The bird died a few hours after its capture, by an old wound—the right foot was missing. Bailey, in his 'Birds of Florida,' p. 13, states that Leach's Petrels "can be seen off our coast in the Gulf Stream during April and September." Howell, in his 'Florida Bird Life,' did not accept this statement as sufficient evidence to include the bird in his Florida list, but he does mention Bailey's statement in the Hypothetical List at the end of his volume. With the collection of this specimen at Daytona Beach, Leach's Petrel is now properly an addition to the avifauna of Florida.—R. J. Longstreet, *Daytona Beach, Florida.*

A Raven's nest near Lexington, Virginia.—Egg dates for the Northern Raven (*Corvus corax principalis*) from the southern mountains are so few that it seems advisable to put on record a set of six eggs from Virginia. I shall not give a definite location for the nest except to say that it was in a cliff at the top of a mountain in Rockbridge County, near Lexington, Virginia. On February 28, 1944, Col. Robert P. Carroll, Mr. Jacob Hostetter and I visited the nest. Placed in a recess about forty feet up a sheer cliff and under an overhang, the nest was inaccessible, but we were fortunate enough to discover a place which could be reached from the top of the cliff and from which we could look into the nest. It was almost completed but empty. Seventeen days later, on March 16, Mr.

Hostetter, my son Jimmy, and I again visited the nest, this time to find six eggs. Since it would have taken several days after our first visit for the completion of the nest and since there had been unusually cold weather up until four days before our second visit, the likelihood is that the eggs were fairly fresh on March 16. However, the fact that one of the birds left the nest as we approached and returned as soon as we started down the mountain would indicate that incubation was under way. The eggs were decidedly elongate. The nest was thickly lined with sheep's wool, probably with other animal hair also, as we found tufts of opossum fur at the base of the cliff. This nesting is probably somewhat late. Last year another nest had feathered young on March 28, although in most years it is mid-April before the birds are large enough to stand up in the nest.—J. J. MURRAY, *6 White Street, Lexington, Virginia.*

Wherein lies the economic value of birds?—In the latest installment of Bent's Life Histories (U. S. Nat. Mus., Bull. 179: 330, 1942), I find the following statement relative to one of my papers.

"W. L. McAtee (1905), in his paper on the relation of horned larks to agriculture, publishes a long list of the vegetable food, mainly seeds, and the animal food, mainly insects, eaten by these birds, most of which does not apply to the northern horned lark. He has much to say about the injurious effect of weeds on agriculture and the cost to farmers in their control. Horned larks feed largely on seeds, perhaps mainly weed seeds, and so do many other birds, but I have always felt that the good that birds do in destroying weed seeds is a myth. Nature is so prolific in the production and so effective in the distribution of the seeds of plants, that only an infinitesimal percentage of those distributed can possibly find room to germinate; and no matter how many the birds pick up, there are always many times more than enough to cover the ground with verdure in a remarkably short time. Has anyone ever known of a case where birds have kept even one square yard of ground free from weeds by eating the seeds? I certainly have not. Therefore, it seems to me that the eating of weed seeds is a neutral rather than a beneficial factor in the economic status of birds."

This seems rather belated comment on a statement made nearly forty years ago. In fact, the economic status of a bird is almost certain to change in that length of time. In this instance, of the Horned Lark, it has decidedly changed, particularly in California, so that a publication of the year 1905 is no longer pertinent for quotation. More cogent references are:

McAtee, W. L. The need for studies in bird control in California. Calif. Dept. of Agriculture, Monthly Bull., 21: 273–275, 1932.

Piper, S. E., and Neff, Johnson A. Procedure and methods in controlling birds injurious to crops in California. Biological Survey and California State Dept. of Agriculture, 3 pts., 1935–1937 (mimeographed).

However, let us see what I said that started Bent's train of thought about the value of weed-seed eating by birds. My strongest statement seems to be:

"To limit the loss caused by them [*i. e.* weeds] an unending warfare must be waged by the farmer. Any allies in this defensive warfare should be welcomed, and of such allies the seed-eating birds are the most important. The farmer, by the expenditure of time and labor, can destroy the weeds when they have sprouted, or later before they have ripened seed. But the seeds which are on and in the ground and which remain there for an indefinite period awaiting favorable opportunity for germination, it is not practicable for man to destroy. This portion of

the work the birds attend to, and among the birds most actively engaged in consuming weed seeds the horned larks are conspicuous."

Bent's challenge is: "Has anyone ever known of a case where birds have kept even one square yard of ground free from weeds by eating the seeds?" Sylvester D. Judd in 'Birds of a Maryland farm' (U. S. Biol. Survey, Bull. 17: 79, 1902), answered this question forty years before it was put, in the following language:

"In the last week of April an attempt was made to ascertain what proportion of the weed seeds ripening on the farm had been consumed during the previous half year. In the wheat field of lot 4, where at the beginning of October there had been scores of seeds on every ragweed plant, it was difficult to find in a fifteen-minute search half a dozen remaining. In the truck plot of lot 3, which had borne a thick growth of pigeon-grass, examination of an area where there had been hundreds of seeds the autumn before would sometimes fail to disclose one, and in a mat of crab-grass in the same field frequently not one was left out of a thousand present in October."

E. H. Forbush, not much later, gave supporting testimony ('Two years with the birds on a farm': 12–14, 1908):

"In our garden we attempted to keep the weeds in subjection. This in 1900 was almost an impossibility. In 1901 it was a serious task and necessitated frequent weeding or hoeing all summer and into the fall. In 1902 the labor was much lightened, and this was in part due to the birds. All farmers know that while hoed crops in the main may be kept nearly free from weeds it is impossible to weed a squash or melon patch without injuring the plants. Such crops invariably foul the land. It is also very difficult to keep all fences and borders of fields clear of weeds. We depended mainly on the birds to take care of such weed seeds as were left in the squash or melon patch or along the borders, and they did their work well.

"The first year birds were not numerous enough to destroy all the weed seed; the second year there was hardly enough seed to gather an increased number of birds."

Even though concrete examples of the extirpation of weed seeds could not be cited, the assertion that "the eating of weed seeds is a neutral rather than a beneficial factor in the economic status of birds" is conservation defeatism. Weed seeds are upon the same basis as other potentially harmful organisms eaten by birds and the same conclusions apply to them. As a rule, despite predation by birds (and other enemies), insects, like weeds, are present in about the same numbers this year as last; so are mice or any other natural food item one may care to mention. Except locally and unusually, birds do not extirpate populations of any of their food species. If we had to base our arguments for the value of birds upon such instances alone, we would be in a very poor position.

However, as Professor F. E. L. Beal remarked long ago (Yearbook, U. S. Dept. of Agriculture for 1908: 347, 1909): "It would appear that the true function of insectivorous birds is not so much to destroy this or that insect pest as it is to lessen the numbers of the insect tribe as a whole—to reduce to a lower level the great flood tide of insect life." The same is true of weed seeds. In similar vein, I have stated (Wilson Bull., 43: 29, 1931): "What needs to be kept in mind at all times is that in assigning economic values to natural enemies, it is best to speak in terms of tendencies rather than of achievements. Good economic tendencies are as satisfactory as any grounds for advocating the protection of natural enemies."

Whatever difficulty there may be in seeing directly beneficial results from the consumption of weed seeds by birds, the economic tendency of this activity is certainly in a beneficial direction. It may not be great but it is good. It can not properly be called neutral for that term can be correctly applied only to the relationships of birds to neutral things.—W. L. McAtee.

Vesper Sparrows mated two successive summers.—On June 12, 1943, in Pennfield Township, Calhoun County, Michigan, I found the nest of a Vesper Sparrow, *Pooecetes gramineus gramineus* (Gmelin), containing four fresh eggs, weighing 11.5 grams. These eggs measured 22.5 x 16, 22 x 15.5, 22.5 x 15.5, and 22.3 x 16 mm. Three of them hatched on June 24, the fourth on June 25. On June 30, both parents were captured at the nest with a funnel trap and marked with colored bands as well as aluminum ones. On July 2, the three remaining young also were banded. The birds were observed periodically during July but no other nest was found.

The first male Vesper Sparrow returned to the area on April 7, 1944, and on April 20, 1944, the male of 1943, marked with the colored bands, was battling for territory with two neighboring males. He settled on the same side hill for the second successive year, but a nest was not found until May 25, 1944. On that date it contained two young about three days old and one unhatched egg (the egg measured 22.5 x 16.7 mm.). One young died from an undetermined cause. The female was almost immediately observed and was found to be the bird banded the previous year and thus mated for the second season to male 41-120096. She was observed periodically during the summer but no other nests of the pair were found. The one young left the 1944 nest on May 31.—Lawrence H. Walkinshaw, *Battle Creek, Michigan.*

Sitka Crossbills in Massachusetts.—Examination of the Red Crossbills in the F. Seymour Hersey bird collection, recently donated by Mr. Hersey to the Cleveland Museum of Natural History, reveals eight specimens of the Sitka Crossbill (*Loxia curvirostra sitkensis*) from Massachusetts. Four males and two females were taken at Chatham, Mass., on December 27, 1919. The other two, both females, were secured on January 22, 1920, at the same place. These specimens were compared with a large series of *Loxia c. sitkensis* from coastal Oregon and the identifications were later corroborated by Dr. Harry C. Oberholser.

Griscom (Proc. Boston Soc. Nat. Hist., 41, No. 5: 123–124, January, 1937) has recorded in his excellent *A Monographic Study of the Red Crossbill* a single Sitka Crossbill collected in Massachusetts during the winter of 1887–1888, and two others taken in that state in the winter of 1899–1900. He lists a fourth Massachusetts-taken specimen (tom. cit., p. 158) which apparently is without date.

The Hersey collection, then, adds eight instances of the occurrence of the Sitka Crossbill in Massachusetts and demonstrates a third winter, that of 1919–1920, as one in which this small crossbill is known to have visited that state.—W. Earl Godfrey, *Cleveland Museum of Natural History, Cleveland, Ohio.*

RECENT LITERATURE

Terrestrial locomotion of the vertebrates.[1]—From the short title of this book, the ornithologist might expect to find some discussion of flight, but this mode of progression receives scant attention, as the full title may be taken to give warning. In so far as birds are fitted for traveling on the ground, they receive their due share of the discussion although the more purely terrestrial vertebrates—the reptiles and mammals—occupy the more prominent place.

According to Dr. Howell's view, the protoave was not lizard-like, crawling up the trunks of the trees, but a reptile able to progress at speed bipedally and hence fitted and inclined to hop briskly from branch to branch. Its arboreal life was thus essentially saltatorial as that of the bird is today. Its fore limbs were evidently not used in cursorial progression as much as the hind limbs or they would not have developed alone into wings but flying would have been accomplished by both pairs of extremities. *Archaeopteryx* and *Archaeornis* both had saltatorial hind limbs. Ninety per cent or more of the land birds have limbs of higher cursorial specialization anatomically than all but the most highly adapted mammals, even including the weak-legged goatsuckers. The most cursorial birds have musculature but little different from that of the slower forms.

On the other hand, as Dr. Howell points out, a long tail is a characteristic of the swifter tetrapod reptiles and those with long necks, whereas all birds have the caudal structure very greatly abbreviated in an obvious adaptation for flight. Hence he concludes that the shortened caudal vertebrae in the flightless Palaeognathae are valuable evidence that they, in common with flying birds, are descended from flying arboreal ancestors, at least from an ancestral stock that could glide easily though probably not fly very efficiently.

The skeletal structure and musculature of the vertebrates are discussed in detail with the evolution of the anatomical characteristics that are important in the function of terrestrial locomotion. The evolution of the pectoral and pelvic girdles and the limbs attached thereto, methods of securing support and balance, and similar details are presented well and graphically. In the case of the birds, only the pelvic girdle and limbs are treated since these alone are functional in the sense of the scope of the book.

Considerable attention is given to the gaits of mammals, but those of birds are so much simpler that they demand less discussion. The majority of birds walk, but many that live much of the time in trees hop, as did the arboreal bipedal reptiles. However, it is not possible to segregate natural groups of birds on this basis. Dr. Howell considers the difference between the saltatorial and cursorial types of birds to be slight and to involve chiefly, if not exclusively, the functioning of the nervous system.

In spite of its necessary emphasis on mammals, the book contains a great deal of valuable information about birds and the ornithologist will profit by its discussions. One may wish that the author, with his experience as an anatomist, will some day give us a similar discussion of aerial locomotive in the vertebrate in which birds will, of necessity, occupy the major place.—J. T. ZIMMER.

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[1] Howell, A. Brazier. 'Speed in animals / their specialization for running and leaping.' 8vo, pp. xii + 270, figs. 1–55, 11 vignette headings, 1944. University of Chicago Press, Chicago, Illinois. Price, $4.00.

Notes on the Procellariiformes.[1]—To state that this work is a puzzling production would put the case mildly. It discusses genera, species, and subspecies of Procellariiform birds, real or alleged, in an extremely disconnected and scrambled manner. The numerous headings represent neither chapters nor a systematic list of forms, and when one reads on pages 20 and 21 a discussion under the title, "Is matsudairae a species?," one is hardly prepared to skip through four other groups of petrels and albatrosses on the next eight pages and then to come back to another whack at *matsudairae*, attached to a generic name not previously used. In fact, the multiplicity of short 'news-line' headings reminds the reviewer of nothing so much as the similar headings in James Joyce's 'Ulysses.'

A curious characteristic of the ornithological treatment lies in the asking of many questions, toward the answering of which no attempt appears to be made. One example of this methodology is the following sentence, which relates to forms of the genus *Pterodroma:*

> "Should *neglecta* 1863, *arminjoniana* 1869 and *heraldica* 1888 be treated as nearly related forms?"

This question could in all probability not be answered solely by reference to the literature, but inspection of any adequate series of specimens would show that *arminjoniana* and *heraldica* are exactly the same species, and that *neglecta* is, indeed, a closely related form.

The second half of this frankly confusing publication contains keys to the families, genera, and species of petrels and their allies, and long tables giving the amplitudes of taxonomic measurements, as drawn from the publications of various students.

The junior author of the work, Mr. E. J. L. Hallstrom, seems not to have figured previously in ornithological literature. A genus *Hallstroma*, which most authorities will regard as synonymous with *Pterodroma*, is named for him on page 37. This "differs from other Pterodromine birds, having a quiet disposition." There are also descriptions of three or more new subspecies and other categories well concealed in the text, such as the subgenus *Stonowa* (p. 27) and the race *Cymochorea leucorhoa muriwai* and the subgenus *Salviprion* (p. 30).—R. C. Murphy, *American Museum of Natural History.*

A study of the American Woodcock.[2]—In the belief that Maine supported a larger breeding population of the American Woodcock than any other state in the Union and in view of the fact that a refuge for the species, established by the U. S. Fish and Wildlife Service, already existed in the state, that region was chosen as the field for the investigation reported in the present paper. It is a study of the species in particular relation to game management, although considerable information of wider application is included. The authors have endeavored, however, to avoid duplication of the work done by Pettingill in his excellent monograph (Mem. Boston Soc. Nat. Hist., 9: 167–391, 1936) except in the field of management. They have drawn on a wide variety of published information and acknowledge the assistance of numerous collaborators, all of which helps to make the account more complete.

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[1] Mathews, Gregory M., and Hallstrom, E. J. L. 'Notes on the Order Procellariiformes.' 8vo, 62 pp., folding keys. Canberra, 1943. Price, 12 shillings 6d.

[2] Mendall, Howard L., and Aldous, Clarence M. 'The ecology and management of the American Woodcock.' 8vo, pp. x + 201, pls. 1–14, figs. 1–11, 1943. Maine Cooperative Wildlife Research Unit, Orono, Maine.

Weights and measurements of many individuals, later dissected, were taken to determine the most reliable distinction between sexes, but enough overlap was found to make clear distinction not always certain. The length of bill was discovered to be the most reliable external factor.

Distribution and migration are discussed, and courtship and mating behavior are carefully reported. Contrary to the opinion of various other workers, the authors found no evidence of polygamy and consider the species essentially monogamous, at least so far as the problems of game management are concerned. Studies of territory showed evidence in agreement with previous accounts that males frequently return to the same territory in a succession of years—a point important in management. Nesting activities, feeding habits, cover preferences, and similar factors are of primary interest in the same connection. Limiting factors in the bird's struggle for existence are analyzed and management practices, based on all this information, are proposed and discussed.

No evidence was found of the reputed powers of the bird to "withhold" its scent in emergencies. The participation of the male in incubation duties was still left uncertain but no positive evidence was obtained that he ever took part in this task.

The authors find the need for planned management immediate. The bird is free from organic disorders, which simplifies the problem to that extent. The house cat was found to be the most serious predator but an overproduction of egg-eating mammals in any locality may require some predator control. Artificial propagation is not promising since there are no records of the species breeding in captivity.

The establishment of refuges is recommended, to the number of fifteen, at least, throughout the breeding range of the species. Each of these is to be from 3000 to 10,000 acres in extent although each may be broken into smaller units of a few hundred acres. The preparation of artificial singing grounds is recommended [but since each of these would be occupied by a single male to the exclusion of others, the number required might entail considerable expenditures!], and preservation of cover is essential. Hunting should be watched carefully for critical changes in population that may require immediate alteration in seasonal regulations.

The report is a comprehensive but succinct little brochure that may be read with profit by anyone interested in this important game bird from the standpoint of a game manager, sportsman, or general ornithologist.—J. T. Zimmer.

A classical lexicon for naturalists.[1]—In this convenient volume, the author has defined a long list of classical words that are suitable for use in biological nomenclature. The Greek words are given in their Latinized forms but with the Greek originals parenthetically added. Primary and some secondary accents are indicated and combining forms are appended with their changes of accent when required. Derivations and synonyms are added in many cases.

No attention is paid to improperly spelled or constructed terms nor to otherwise barbarous terms, nor are personal and place names included. On the other hand, an effort has been made to include all the names given by the Greeks and Romans to plants and animals, however obscure or unidentifiable these may be today. Many of these ancient terms are now applied to the same forms or groups as they

[1] Woods, Robert S. 'The naturalist's lexicon / A list of classical Greek and Latin words used or suitable for use in biological nomenclature / with abridged English-Classical supplement. 8vo, pp. xvii + 1, 1–282, 1944. The Abbey Garden Press, Pasadena, California. Price, $2.75 (plus postage); foreign, $3.00.

originally were, or to their near relatives, but others are not, as is evidenced by the generic name *Colius*, originally, according to the lexicon, applied to the Green Woodpecker!

To make the lexicon more usable, there is a classified condensation of the more important words arranged in an English-Classical supplement. Here the English names of the animals and plants (variously segregated), physiological terms, habitats, adjectives, numerals, colors, physical qualities, verbs, prefixes, and other general terms, are listed alphabetically with their various Latin (or Latinized Greek) equivalents. It gives a ready source of suggestion to the taxonomist in search of a satisfactory term to bestow on his new form or group.

In an introductory chapter there is a brief discussion of the proper construction and pronunciation of classical words which can be studied to advantage by those whose familiarity with Greek and Latin may be restricted to the classical or pseudo-classical names that are found in biological literature, usually without their derivations.

The volume makes a handy reference work that should find a welcome reception for the systematist's book-shelf.—J. T. Zimmer.

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CORRESPONDENCE

The Bronzed Grackle as a Species

Editor of 'The Auk':—Whether or not the A. O. U. Committee's decision to accord full specific rank to the Bronzed Grackle meets with general approval, it certainly will stimulate thought concerning the subject of speciation, and discussion among those who are not made inarticulate by what they may feel is beyond their depth.

From 1924 to 1929, I studied Pennsylvania's grackles assiduously, interesting myself especially in areas in which the range of the so-called Purple Grackle met that of the Bronzed. My paper covering this subject was never published, but I now contemplate with interest the belief expressed therein that the Bronzed Grackle may have spread northward through the United States from Mexico while the Purple Grackle's ancestors came from the West Indies by way of Florida—in short that the two were distinct species whose evolution was so essentially convergent that when they finally did meet in various parts of the eastern and southern United States they readily interbred.

This concept intrigued me. But I now believe I was wrong, and I believe the Committee's decision—whatever the basis therefor—is wrong, for when two or more anatomically very similar forms have the same color-pattern, call-notes, courtship behavior, nesting habits, roosting habits, molts, foods, etc., and interbreed indiscriminately wherever they occur together, they certainly must be called the same species if the term is to have a truly biological meaning. The Bronzed Granckle and Purple Grackle have spread out over considerable areas in which they now "geographically replace" other forms of the genus. Each has evolved color-characters which make average specimens instantly recognizable. But no mechanism has ever completely, or more than temporarily, isolated either. Wherever *Quiscalus* has spread, it has nested more or less colonially in drowned woodlands, in clumps of coniferous trees in villages, in bois d'arc hedges, in bridges and buildings, even in cattail marshes, and obtained food in fields, meadows, forest edge, and open woodland close by. This sort of summer *oikos*, or home, has been readily available to all forms of the genus as they have spread northward and northwestward from Florida.

It is interesting, and desirable, to consider the possibility that the Bronzed Grackle may have budded off and become a full, separate species; but so long as the bird itself recognizes no essential differences between itself and other forms of its genus with which it comes in contact during the breeding season, ornithologists may well accept its own obviously satisfactory decision in the matter and name it accordingly.

George Miksch Sutton
Major, Air Forces

NOTES AND NEWS

Two vessels have been named in honor of former members of the American Ornithologists' Union. Last year the "Hugh M. Smith" was named in honor of the late Commissioner of Fisheries, and recently the "William E. Ritter" was launched in California and named in honor of the first Director of the Scripps Oceanic Laboratory at La Jolla, California.

Occurrence of the Golden Plover in Nicaragua

Luis Marden, in 'The National Geographic Magazine' for August, 1944, p. 180, reports the capture of a specimen of the Golden Plover on April 17, 1942, at Granada on the northwest shore of Lake Nicaragua. The bird was collected by Father Bernado Ponsol, Rector of the Colegio Centro-América and provides a positive record of the occurrence of this bird in Nicaragua and one of the few records of the species between Panama and Mexico.—T. S. Palmer.

The Deane Collection

Ten years have elapsed since the Deane Collection of Ornithological Portraits was transferred to the Library of Congress and made an integral part of the national collections of portraits. During these years, some of the older Fellows and Members of the Union have died, new ones have been elected, and many biographical data hitherto inaccessible have become accessible. All of these changes necessitate many additions to the data on the index cards. Present plans for work on the collection include bringing the index up to date and acquisition of as many as possible of the portraits of new members and of the older members still missing. It is also proposed to add portraits of individuals mentioned in the 'Check-List of North American Birds,' either as describers of genera and species or as persons in whose honor birds have been named. An effort is also being made to obtain copies of portraits listed in the Leverkuhn Collection, formed by Dr. Paul Leverkuhn, Librarian and Private Secretary of H. R. H. Prince Ferdinand of Bulgaria. This collection, the largest of its kind, contained 515 items but was dispersed after the death of Leverkuhn. The Deane Collection now contains portraits of more than 1000 persons and as many as 18 of one or two individuals.—T. S. Palmer.

NOTICE

The Editor wishes to call attention to the inside back cover of 'The Auk.' From gradually increasing evidence, it appears probable that many members of the A. O. U. are unfamiliar with this page! Suggestions for the preparation of manuscripts are given and attention to these by contributors will be gratefully appreciated.

On the other hand, communications relating to changes of address, subscriptions, purchase of back numbers, and such matters are outside the jurisdiction of the Editor and should be addressed to the Business Manager. Since these two officers are not in the same city, considerable time is lost in getting misdirected correspondence into the proper hands.

CORRIGENDA

In the October issue of last year (vol. 61, no. 4), through an unfortunate error, for which the Editor is to blame, the captions of several figures on Plates 20 and 22 became transposed. For the title of the bottom figure of Plate 20, read that of the middle figure of Plate 22; for that of the middle figure of Plate 22, read that of the bottom figure on the same plate; for that of the bottom figure of Plate 22, read that of the bottom figure of Plate 20.

OBITUARIES

EDWARD CHARLES STUART BAKER, an Honorary Fellow of the American Ornithologists' Union, died at his home in Upper Norwood, England, April 16, 1944, at the age of seventy-nine. He was the son of E. B. Baker and was born in 1864. He received his education at Trinity College, Stratford-on-Avon, and, following in the footsteps of his father who had served in the Indian Police, he received an appointment in the same service in 1885. He served almost entirely in Assam, in northeast India, and finally became Inspector General of the Province. In 1912, on his return to England, he was given the assignment of reorganizing the Port of London Police and remained in command of the force until his retirement in 1925. When he returned to England, he settled in Upper Norwood, took great interest in local affairs, and was elected Mayor of Croydon for 1938–1939. Later he was elected an Alderman and resigned from the Council in 1942.

In India, Baker had many opportunities to study natural history and indulge in big game hunting. While hunting he lost his left arm in an encounter with a leopard, was twice tossed by a bison, and was trampled by a rhinoceros. In spite of the loss of his arm he was an excellent shot and a good tennis player. His work in ornithology began in India in collecting birds and eggs and contributing notes and observations to 'The Ibis.' He also contributed to the 'Journal of the Bombay Natural History Society' much of the material that later appeared in book form in 'Indian Ducks and their Allies,' 1908. He published 'Indian Pigeons and Doves' in 1913 and 'Game Birds of India, Burma, and Ceylon' in three volumes, in 1921–1930. He revised the 'Birds of India' by Oates and Blanford, expanding the original four volumes to eight, which appeared between 1922 and 1930. Later he brought out four more volumes on 'The Nidification of the Birds of the Indian Empire,' 1932–1935.

Baker was elected a Member of the British Ornithologists' Union in 1892 and served as Honorary Secretary and Treasurer from 1913 to 1936. In 1918, he was elected a Corresponding Fellow and in 1920, an Honorary Fellow of the American Ornithologists' Union. He was particularly interested in the Old World cuckoos and their habits and brought together a notable collection of cuckoo eggs which is now in the British Museum (Natural History). In 1942, he published a volume entitled 'Cuckoo Problems,' containing a comprehensive discussion of the parasitic habits of the birds. The eastern-Asiatic form of the cuckoo has been dedicated to him by Hartert under the name *Cuculus canorus bakeri*. This form, which has occurred accidentally in 1930 on St. Lawrence Island in Bering Sea, Alaska, is now included in the 'Check-List of North American Birds.'—T. S. PALMER.

DAYTON STONER, an Associate of the A. O. U. from 1922, and a Member since 1935, made ornithology the principal interest of his later career. Earlier he had rendered significant contributions to the fields of both entomology and mammalogy. Of nearly a hundred publications on ornithology, 16 related to the life-history, and especially to growth and temperature range, of the Bank Swallow. He made this field his own and extended it to the House Wren and Phoebe, as well as to other swallows. Some of the results remain to be published and they are being prepared by Mrs. Stoner, who was ever an active associate of her husband in field work. Bird-banding, used in all his detailed studies, was also pursued in a general way, leading to several publications on results obtained in Michigan and Iowa. The University of Iowa Service Bulletins he prepared, entitled 'Bird Migration,'

'Spring Birds,' 'Winter Birds,' 'Planting for the Birds,' and 'Summer Birds in Iowa,' were reprinted from time to time in response to popular demand. In number of pages (nearly 500), the 'Ornithology of the Oneida Lake Region' (Roosevelt Wildlife Annals, 2 (3–4), Jan., 1932) surpassed any other of his papers on birds.

In an investigation of the natural enemies of the leaf-tyer and other insect pests of celery in the Sanford, Florida, district, Stoner collected many birds and he and others together analyzed the contents of about 500 stomachs. An extensive report upon this study is in the files of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, and another embodying a summary of the results respecting birds was prepared and accepted for publication by the Biological Survey (now Fish and Wildlife Service of the U. S. Department of the Interior) in the archives of which it still lies. This paper contains much new information on the economic value of birds and is eminently worthy of publication.

Stoner took great interest in the Bird Day Bulletin to the Schools in New York. Each year, besides contributing to this bulletin himself, he wrote many letters soliciting articles from others that would keep the publication of state-wide pertinence and interest. Often the essays received had to be rewritten to meet the requirements of the bulletin. This work he continued for twelve years. In a way this may be thought of as a continuation of his teaching at the University of Iowa (1908–1928). Ornithologists who started their work there under Professor Stoner include A. M. Bailey, L. L. Snyder, W. F. Kubichek, and W. J. Breckenridge.

He was a member of the A. O. U. Committee on Bird Protection in 1943. Of other ornithological societies he affiliated with the Massachusetts Audubon Society, National Audubon Society, Wilson Ornithological Club, Northeastern Bird Banding Association, and the Iowa Ornithologists' Union.

Stoner was born at North Liberty, Iowa, November 26, 1883, and died at Albany, New York, May 8, 1944. A fuller account of his career by the present writer was published in 'Science' (100: 68–69, July 28, 1944) and an appreciation by John J. Elliott in a number of Long Island (N. Y.) newspapers of June 23, 1944. I end this statement as I did the former with the following well-deserved encomium: Stoner was systematic and conscientious in his work and conservative in reaching conclusions. He was always optimistic and pleasant and leaves a memory that will be treasured by his friends.—W. L. McAtee.

George Franklin Clingman, an Associate of the American Ornithologists' Union for eight years, died in Chicago, Illinois, February 3, 1933, at the age of seventy-five. He was the son of pioneer Chicagoans and was born in Chicago, August 27, 1857. Nearly all his business career was passed in the furniture business. In 1879 he became designer for John A. Colby and Co., in 1888 joined the Tobey Furniture Company in a similar capacity, and in 1894 became Vice-President and General Manager of the company—a position which he retained until his retirement in 1932.

Mr. Clingman was much interested in birds and devoted some of his spare time to work in taxidermy. He made a collection of Illinois birds which he gave to the U. S. National Museum and mounted a collection of Cook County birds, now in Bryn Mawr College. He was elected an Associate of the A. O. U. in 1924. Seven children survived him, including three sons: J. Stuart, George F., and William H. Clingman; and four daughters: Elizabeth Seafield, Louisa Barat, Lucy Abel, and Ruth Mois.—T. S. Palmer.

DR. WILLIAM CEPHAS HERMAN, an Associate of the American Ornithologists' Union, elected in 1921, died October 24, 1944, at his home in Cincinnati after an illness of about a year. He was seventy-one years of age, having been born in Glendale, Ohio, September 16, 1873. He graduated from the College of Pharmacy and the Miami Medical School and after graduation engaged in the practice of medicine and taught pharmacy at the General Hospital for several years.

He and Mrs. Herman were regular attendants at the annual meetings of the Union and took an active part in the outings and social features of the conventions. When bird-banding first became organized, he took an active part in the work. He was much interested in bird protection and developed the grounds about his home in a way to attract native birds. In 1931 he made a trip through the Everglades of Florida, reporting briefly on the status of some of the rarer species ('The Auk,' 48: 332–333, 1931). About 1933 he was one of the leading advocates of a plan to license cats as a means of decreasing the destruction of native birds.

Dr. Herman was a great reader and became one of the leading borrowers from the Public Library from which he estimated that he had borrowed about 10,000 books since 1900. He was interested in photography and on his vacation trips in later years carried a color movie camera. He was also much interested in trying to determine the fate of William Bullock, proprietor of Bullock's Museum in London, whose name is borne by a conspicuous western oriole and who was said to have settled near Cincinnati about a century ago. Dr. Herman made several efforts to collect information regarding Bullock's later years but unfortunately was unable to complete his investigation before his death. He is survived by his widow, Irene Chapman Herman, of Cincinnati, and two brothers, Charles and Oliver Herman, both of Glendale, Ohio.—T. S. PALMER.

WILLIAM ANTHONY KELKER, an Associate of the American Ornithologists' Union, elected in 1896, died from a heart attack, south of Rockville, near Harrisburg, Pennsylvania, February 15, 1908, at the age of 54. He was born in Harrisburg, September 20, 1853, and received his education in the public schools and at Harrisburg Academy.

Mr. Kelker was an amateur weather observer and at the time of his death was returning with a friend from Wetzel Swamp which they had visited in search of the first signs of spring. Mr. Kelker was an authority on the history of the Indian tribes which formerly inhabited the Susquehanna Valley, and had a collection of arrowheads, spearheads, ceremonial stones, and Indian pottery. Apparently, he contributed no notes to 'The Auk' and published little, if anything, especially on birds.—T. S. PALMER.

DR. LEWIS RUTHERFORD MORRIS, a Life Associate of the American Ornithologists' Union, elected in 1923, died of cerebral hemorrhage at his home in New York City, December 9, 1936, at the age of seventy-four. He was the son of James Rutherford and Ellen Elizabeth Howe Morris, of Morris, New York, and was descended from Lewis Morris, a signer of the Declaration of Independence. He was educated in New York and received his medical degree in 1884 from Bellevue. In 1899 he was a member of the Harriman Expedition to Alaska.

Dr. Morris was a founder and member of the Board of Trustees of the New York Zoological Society, a trustee of the Corcoran Art Gallery of Washington, D. C., a former chairman of the Commission for State Police of New York, and a member of the Century and Metropolitan clubs. He was interested in hunting and in

big game and was a member of the Southside Sportsmen and Boone and Crockett clubs. He married Katharine L. E. Clark, a daughter of the late Senator Wm. A. Clark of Montana, and was survived by his widow, a daughter, Mrs. John Hudson Hall of Hartsdale, New York, and two sisters.—T. S. PALMER.

FRANCIS HOPKINSON SMITH, an Associate of the American Ornithologists' Union, elected in 1938, died at Rocky Mount, North Carolina, October 14, 1941. He was born in Suffolk, Virginia, in 1875, and at the time of his death was sixty-six years of age. Descended from a long line of Episcopal clergymen, he received his A.B. degree at the University of the South and his B.D. at the Sewanee Divinity School, and took up his residence in 1921 at Rocky Mount, where he became rector of the Church of the Good Shepherd.

Mr. Smith was an active field observer and was in the habit of taking a daily early morning trip around Rocky Mount which afforded him an opportunity of making many interesting bird notes. He secured the first specimen of the Florida Red-shouldered Hawk taken north of Florida and sent it to the State Museum. He discovered the breeding of the Yellow-crowned Night Heron and Prairie Horned Lark, and the occurrence of Brewster's and Lawrence's Warblers, the northern Phalarope and Golden Plover at Rocky Mount. Many of his notes were published in 'The Chat,' the Bulletin of the North Carolina Bird Club, an organization of which he was a charter member and second president. He was much interested in young people and active in the work of the Boy Scouts, often taking some of the Scouts with him on his field trips.

A sketch of his activities by the Reverend John Grey, from which the above facts were obtained, may be found in 'The Chat' for September, 1941.—T. S. PALMER.

GEORGE WHITNEY WHITE, a Life Associate of the American Ornithologists' Union, died in Washington, D. C., October 27, 1938, in his 69th year. He was the son of George Henry Barron and Frances Virginia (Withers) White and was born in Washington, D. C., February 11, 1870. He was educated in the National Capital, at the Emerson Institute, and at the age of fifteen entered the service of the National Metropolitan Bank while his father was serving as cashier. In 1904 he organized the Commercial National Bank and, after serving five years as cashier and vice-president, returned to the Metropolitan and was elected its president. He had now become one of the prominent bankers of the Capital and continued as president of the Metropolitan Bank until his death. He also took a prominent part in the management of various civic enterprises and served as treasurer of the American Automobile Association, the American Civic and Planning Association, and the Emergency Hospital.

While not primarily an ornithologist, Mr. White was a patron of science, was interested in birds, and, in 1924, was elected a Life Associate of the Union. For many years the National Metropolitan Bank was the depository of the funds of the Union and continued to serve in this capacity until the election of a treasurer in Chicago necessitated the transfer of the funds to that city.—T. S. PALMER.

THE AMERICAN ORNITHOLOGISTS' UNION AT A GLANCE

Organized—in New York City, Sept. 26, 1883: Incorporated—in Washington, D. C., Nov. 15, 1888.

Objects: "The advancement of its members in Ornithological Science; the publication of a journal of Ornithology and other works relating to that science; the acquisition of a library; and the care and collection of materials relating to the above objects, under the restrictions and regulations established in its By-Laws."

Officers: President, two Vice-Presidents, Secretary, Treasurer, and 9 elected Councilors. Two Councilors appointed by Cooper Club and Wilson Club. Officers, the Editor and ex-Presidents are ex-officio members of the Council.

Members: Associates (unlimited), Members (150), Corresponding Fellows (75), Honorary Fellows (20), Fellows (50), Fellows Emeriti, Patrons. (Total membership in 1945 about 1700.)

Dues: Annual—Associates $3, Members $4, Fellows $5.
Life-Members of any class $100; Patrons $1000.

Income: From annual dues, sale of publications, life memberships, and contributions.

Meetings: Annual—usually in October or November.

Publications: 'The Auk,' a quarterly journal in 62 volumes, with 5 general indexes: 1876–1900, 1901–1910, 1911–1920, 1921–1930, 1931–1940. 'Check-List of North American Birds': 1st ed., 1886; 2d ed., 1895; 3d ed., 1910; 4th ed., 1931. 'Code of Nomenclature,' 1886; Revised ed., 1908. (See Auk, '24, 142.)

Brewster Medal: The income from a fund of $7250, established in 1919 by the friends of William Brewster, awarded biennially (now annually) to the author of the most important work relating to the birds of the Western Hemisphere published during the preceding six years. Awarded in 1921 to Robert Ridgway, in 1923 to A. C. Bent, in 1925 to Todd and Carriker, in 1927 to John C. Phillips, in 1929 to C. E. Hellmayr, in 1931 to Mrs. Florence M. Bailey, in 1933 to F. M. Chapman, in 1935 to H. L. Stoddard, in 1937 to R. C. Murphy, in 1938 to Thomas S. Roberts, in 1939 to Witmer Stone (posthumously), in 1940 to James L. Peters, in 1941 jointly to Donald R. Dickey and A. J. van Rossem, in 1942 to Margaret M. Nice, in 1943 to Alden H. Miller, in 1944 to Roger Tory Peterson.

WHERE TO FIND FURTHER INFORMATION

Addresses of Officers and Members—Annual list usually in April Auk. Copies of last list (1942) available at 50 cents each.

The Auk (Location of sets)—Auk, '19, 634; '20, 348; '24, 207; '29, 584.

The Auk in Public Libraries—Auk, '30, 609.

Biographies of Deceased Members—Auk, '35, lviii and current issues.

Brewster Medal—Auk, '20, 29; '22, 86; '24, 125; '25, 484; '26, 69; '28, 71; '30, 219; '32, 52; '34, 53; '36, 57; '38, 317; '39, 113; '40, 142.

By-Laws: Auk, '27, xi; Auk, '38, 330–340.

Dates of Publication of The Auk (1912–1943) follow the Index in each volume or the title pages in later volumes.

History of the Union: Allen, J. A., 'A Seven Years' Retrospect,' 1891; 'The A. O. U.,' Bird-Lore, 1899, 143.
Palmer, T. S., 'The A. O. U.,' Am. Mus. Journal, '18, 473; 'Looking Backward,' Auk, '24, 139; Fifty years' progress of American Ornithology, 1933, 7–27.

Meetings: Auk, '24, 143; '30–'36, back cover of October numbers.

Membership:—Auk, '24, 140; Fellows, '18, 110; Foreign Members, '18, 266; Members, '18, 384; Associates, '18, 513.

Permanent Funds: Auk, '20, 513. (See yearly Treasurer's and Trustees' reports.)

THE AUK

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ORGAN OF THE AMERICAN ORNITHOLOGISTS' UNION

Manuscripts should be typewritten, double-spaced, if possible. Titles should be brief, within one printed line. Avoid footnotes. References to literature may be inserted in parentheses in the text or listed at the end of the paper; consult recent issues of 'The Auk' for the style of citation used. Long articles should have a brief summary at the end. Mark copy only for *italics*. Avoid Roman numerals and extensive or ruled tables. Line drawings should be in India ink on white paper or cardboard; if reduction will be necessary, details must be correspondingly bold. Captions should be brief; discussions belong in the text. Common and Latin names of North American birds should follow the A. O. U. Check-List except in taxonomic papers giving formal discussions of the changes. Except on request, no proofs of 'General Notes' or short communications will be sent to authors.

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FREDERICK C. LINCOLN
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ATTENTION

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It was impossible to get out the bills at the usual time and consequently the January Auk is being sent to everyone on the list in October, 1944. Bills will be sent before the April issue is printed. You will materially help the Treasurer and Business Manager if you will mail your dues immediately, without waiting for the formal notice. Make checks, money orders, etc., payable to American Ornithologists' Union and address to

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